An Investigation into Environmental Sound Levels and Vocal Behaviors of Female Secondary School Choir Teachers: A Collective Case Study

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An Investigation into Environmental Sound Levels and Vocal Behaviors of Female Secondary School Choir Teachers: A Collective Case Study

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Abstract

The purpose of this study was to investigate voice use and vocal behaviors of female middle and high school choral music teachers (N = 3) across three standard school days by measurement of duration of specific vocal activities, average classroom sound levels during specified activities, and self-perceived voice use and classroom sound level for the full day containing middle school choirs, beginning/intermediate high school choirs, and advanced high school choirs. Among primary findings: (a) female secondary choral teachers spent the majority of voice use in the classroom speaking alone, speaking while students are speaking, and singing while students sing with piano accompaniment; (b) female secondary choral teachers spoke more while students were speaking during advanced high school choir rehearsals than middle school or beginning/intermediate high school choirs; (c) female secondary choral teachers sang while students were singing and the piano was playing more often when teaching middle school choir than high school choirs; (d) the highest classroom sound level occurred when teachers were singing along with students singing with piano accompaniment; (e) the use of the piano in the secondary choral classroom was largely responsible for high sound levels; (f) female secondary choral teachers underestimated amount of time spent speaking alone; and (g) female secondary choral teachers overestimated total voice use during instructional time. Results are discussed in the context of previous research, implications for present and future music educators, and recommendations for future research.

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Table of Contents

List of Figures

List of Tables

CHAPTER ONE

Introduction

"Does anyone have any good tips about protecting/preserving your voice throughout your teaching career? It's something I'm nervous about going into this profession" (Stewart, 2016). In the over 21,000 member Facebook group "I'm a choir director," there are frequent posts from teachers pleading for advice about vocal health or requesting strategies to manage a voice loss. Many choir teachers will experience vocal loss to some extent at some point in their careers. A seasoned music educator replied to the above quoted question, "I have to say that 37 years in the teaching field did destroy my voice but first I was not very careful and second it would have gone anyway (sopranos usually do). So, if you love teaching like I do, just accept that you have made a choice that will have some consequences" (Davidson, ca. 2017). A new teacher in 2018 posted the following: "I started student teaching about a week ago. After three straight days of student teaching (talking every hour) and helping the kids learn their parts while modeling and singing with them, I don't have much there at all. How do I model/encourage/help unconfident singers without hurting myself?" (Burkey, 2018). In 2015, a user posted "The past two weeks I have had a very tired and sore throat. I believe it is due to using my voice (singing and speaking) ALL day. What are some things that you do to "save your voice?" I am trying to not use my voice as much and will continue to try and conquer this feat!" (Seamans, 2015).

Among these posts and in many of the comment replies, a common theme emerges, that teachers have concerns about the negative impact that teaching choir could have or has already had on their voices. Many teachers face pressure to continue teaching while experiencing a voice loss, hoarse voice, or vocal pathology and must quickly discover and adopt other teaching methods to supplement their lost vocal abilities. In many of the related posts, choir directors

attribute their vocal loss, voice concern, or vocal pathology to the demands of their job.

An inherent need for the job of choral director is a well-functioning voice. School choral directors employ their voice to model healthy singing, give verbal instruction, answer chorister questions, manage the classroom, and perform administrative duties. Since the voice is critically necessary to job function, school choir directors, and teachers are considered professional voice users. Professional voice users are at heightened risk of developing vocal fold pathologies and trauma associated with overuse and misuse of the voice (Titze, Lemke, & Montequin, 1997).

Teachers are perhaps guilty of talking too much during classes. Dixon (n.d.), a blogger on a teacher development website, recounts his first time recording himself teaching an English class. “I never, ever shut up. Not even for a minute.” He attributes his excessive teacher talk to a few factors: teacher enthusiasm and happiness; attempts to energize sleepy students; filling the silence with chatter; and needing to communicate so many worthwhile comments, instructions, feedback, etc. To address excessive talking, he suggests speaking for no longer than 20 seconds without asking a question that requires a thoughtful answer. Perry (2016) bluntly states “Don’t Talk So Much!” He proposes a shift from the paradigm of music rehearsals being direct instruction (teacher-centered) to a student-facilitated environment. Directors who make frequent and lengthy interruptions may be missing other modes of interaction (e.g. conducting gesture, nonverbal cues, facial expressions) and more importantly, may be interrupting, rather than promoting, musical learning.

According Randall (2012), successful teachers spend between 35% and 45% of rehearsal time talking. Content is an important factor in determining the accuracy of the percentage. Higher percentages may be appropriate in certain circumstances where presented content is engaging and lower during feedback-only situations. Teachers should be mindful of student

posture and facial expression to gauge engagement and determine whether or not too much teacher talk is occurring.

In his review of effective teacher traits, Polk (2012) asserts that research shows expert teachers employ less verbal instruction than novice teachers, and incorporate more positive overtones. Teachers who talk more are perceived as being less effective directors (Goolsby, 1996) and more teacher talk negatively affects attitudes of high school choral students (Nápoles, 2012). Luethi (2017) suggests having students speak, discuss, or sing for 85% of a choral class, while the director is only responsible for the remaining 15%. He proposes eliminating unnecessary words from directives not only increases pacing, but also improves rehearsal efficiency and student attentiveness. Another recommendation is for teachers to be prescriptive in instructions, rather than descriptive followed by a proposed solution, which unnecessarily adds talk time. Finally, Luethi advocates an entire rehearsal where no speaking occurs, but rather only singing by the director and by the ensemble. This forces nonverbal instruction and likely adds variety and efficiency to the teacher's typical instruction.

Unlike Randall and Luethi who define appropriate percentages of teacher talk time, Hans Albanese (2011) proposes that teachers should not talk more than 10 minutes in each class to maximize student learning. The remaining class period should be spent practicing the material, engaging in problem-solving, working on a project, or participating in group work.

In reference to English language instruction, Darn (2006) suggests the disadvantages to Teacher Talk Time, or the time that the teacher is solely verbalizing, include limited student talk time, monotonous pace, under-involved students, loss of concentration, boredom, missed opportunities for student assessment, and lack of students taking responsibility for personal learning. However, teacher talk time that involves questioning or eliciting student responses

requires student engagement. Darn recommends minimizing the amount of teacher talk while simultaneously monitoring the quality of what is being said.

Barrs (2016) differentiates between unaware teacher talk and aware, purposeful teacher talk. He defines unaware teacher talk as "talk that has not been considered or consciously designed. At such times, learners are likely to disengage and become bored, pulling out their smartphones or gazing out the window." He suggests that awareness and purpose transform teacher talk into an effective tool, especially when scaffolded to increase learning. He notes that a mere reduction in teacher talk time is not the only solution, but rather an increase in teacher talk that fosters student engagement. In the choral classroom, it can be more challenging to purposefully plan teacher responses ahead of time, since most often, teachers are providing immediate feedback after student performances. As Barrs points out, too much teacher talk time may have a negative impact on student attentiveness. A large amount of teacher talk time in the foreign language acquisition classroom may de-motivate and confuse students. To minimize the negative effects, teacher talk should be simple and clear; incorporate clear gestures and visual information; and be brief and concise.

To achieve the goal of being concise with directions, Archibeque (1992) suggests using the "rule of seven," or telling the choir what you want in seven words or less. She also proposes allowing students to have a voice in the teaching cycles by providing feedback during the rehearsals and partnering students, a similar suggestion that is frequently given to general classroom teachers that are attempting to cut down teacher talk.

Choral directors rely mostly on their voices to lead music rehearsals through verbal instruction and vocal modeling. According to Polk (2012), modeling is an effective tool for improving student achievement and performance, with or without verbal instruction, and

especially when video or audio examples are included. Musical modeling is a powerful tool employed by music educators and results in better or at least equivalent performance than verbal instruction alone. Verbal instruction and modeling together are not more effective at improving student performance than modeling alone (Rosenthal, 1984). Ebie (2004) also reports that vocal modeling and audio-visual models are both more effective than verbal instruction in eliciting an expressive vocal melody from middle-school subjects.

Furthermore, teachers may not always have a clear idea of how much time they talk during class time. Choir teachers may have a tendency to overestimate their time spent talking. Draut and Broomhead (2017) report that choir teachers significantly overestimate their time spent talking. Interestingly, when compared to males, female teachers are not as prone to overestimating time spent speaking though most teachers report talking more than what they deem a successful director should talk.

Vocal health for teachers is often discussed in research, medicine, and social circles. Suggestions for maintaining vocal health and practicing excellent vocal hygiene range from practical applications to not-so-practical. On the practical end, Duke Voice Care Center proposes hydrating the body, and thus the mucosal membrane of the voice, should be of utmost importance to professional voice users. Avoiding dry environments and drying agents (like coffee and alcohol) will improve levels of hydration. Additionally, teachers should avoid vocal misuse and overuse including avoiding singing without warming up the voice or without singing training, yelling, loud talking, and talking in noisy situations. Duke Voice Care Center offers specific advice to choral music directors including: taking care of the body by getting plenty of rest, exercising, and eating well; warming up the voice before rehearsals; using amplification for the voice during rehearsal; printing signs for instructions; and minimizing voice use to teach the

music. To that end, choral teachers could consider providing recordings for choir members to learn the music outside of the classroom to reduce vocal load. Beyond the music classroom, teachers of any subject can protect their vocal function by doing the following: taking measures to avoid getting sick; taking frequent vocal rests between times of heavy vocal use; work in some "voice naps" during the day; avoid extra voice use outside of work; avoid nonessential voice use if hoarseness occurs; avoid talking over noise; modify classrooms to reduce noise from lights, fans, reverberations, and other classrooms. To best follow these suggestions for daily vocal hygiene, teachers need to monitor not only the amount that they are speaking and singing, but also avoid speaking or singing in noisy environments, which would include avoiding speaking or singing while students are speaking or singing.

Choral directors are no strangers to noisy environments. Choir teachers spend a large amount of their days with varying sized choirs singing, with a piano or keyboard playing, and with students speaking or clapping which can result in high classroom sound levels. The "Lombard effect" may also occur in the choral classroom impacting not only student voices, but also the teacher's voice. Olson (2010) quotes Steven Tonkinson's definition of the Lombard effect:

> There is a masking of an individual voice by the sound of surrounding voices. This masking effect leaves the individual choral singer with less than a desired amount of auditory feedback. I have observed that when the masking effect occurs in the choral environment, there is a tendency for singers to push or force their voices to enhance feedback. (p.145)

The "Lombard effect" may be particularly problematic for the choral director, who is often using the voice to guide an entire voice section and intentionally raising the volume of the voice, which

may compound with the unintentional response to classroom sound. The pushing of the voice to increase feedback of self-sound may lead to vocal fatigue or result in greater vocal issues if prolonged. Olson proposes staying aware of vocal use is the best defense against fatigue associated with the "Lombard effect."

Smith (2013) also discusses vocal disorders among choral music teachers, specifically the effect of background noise on the choral music educator. She suggests that noise occurring outside of the classroom, from neighboring music ensembles or other noisy rooms (e.g. gym, lunchroom) may cause educators to think they must raise their voices to be heard. This practice might result in a shrill or exaggerated vocal habit, which could strain any voice, especially one that is at-risk of being overused due to other job requirements.

To singers attempting to lead a voice section, Sataloff (2017) offers the following advice to reduce negative impact of the Lombard effect: to cup one's ear to increase self-sound by 6 dBA and to "lead their section by singing each line as if they were soloists giving a voice lesson…as if there were a microphone in front of them recording their choral performance for their voice teacher." Combating the "Lombard effect" requires choral directors to remain vigilant about their use of healthy vocal production, as well as develop an awareness of the presence of background noise.

Need for the Study

Choral music teachers are at a high risk of developing vocal problems during their career. Large class sizes, loud environments, and high amounts of vocal use are all contributing factors. The voice is a critical tool that choral directors rely on to communicate concepts, vocally model, correct errors, and provide feedback. Any voice loss or chronic vocal issue quickly impacts the choir teacher's ability to be an effective teacher. While many strategies have been promoted to

assist teachers in maintaining vocal health and hygiene, few directly address the in-class vocal behaviors of teachers.

To specifically address teachers' vocal behaviors and to make appropriate best practice suggestions, more must be known about what is actually occurring in the secondary music classroom and determine the current status of voice use by teachers in the field. To date, no study has investigated the specific vocal behaviors of middle and high school choral music teachers across complete school days, while also gathering live classroom sound levels.

Purpose Statement

The purpose of this study was to investigate voice use and vocal behaviors of female middle and high school choral music teachers ($N = 3$) across three standard school days by measurement of duration of specific vocal activities, average classroom sound levels during specified activities, and self-perceived voice use and classroom sound level for the full day containing middle school choirs, beginning/intermediate high school choirs, and advanced high school choirs.

Research Questions

To that end, the following research questions will guide this investigation:

1) With what duration (minutes and percentage of total voice use) do middle and high school choral teachers participate in specified vocal activities (*speaking alone, speaking while students speaking, speaking while students singing with piano, speaking while students singing without piano, speaking while piano plays, singing alone, singing alone with the piano, singing while students singing with piano accompaniment, singing while students singing without piano accompaniment, no teacher voice use*) throughout the

course of a school day including instruction for middle school, beginning/intermediate high school, and advanced high school students?

2) What is the live sound level (dBA) of the classroom measured for each of the specified vocal activities and classroom activities (*singing at piano dynamic with piano, singing at piano dynamic without piano, singing at forte dynamic with piano, singing at forte dynamic without piano, students "musicing" in non-singing manner*) without teacher vocalization?
3) How does self-perceived teacher voice use and self-perceived classroom sound level in each specified vocal activity compare to actual teacher voice use and actual classroom sound levels?

CHAPTER TWO

Review of Literature

"Among teachers, vocal suicide is considered normal and natural" (Cooper, 1970). Many studies have investigated teacher voices though establishing rates of vocal issues, quality of teacher voices, content of verbalizations, and length of spoken instruction. Yet, no study to date has investigated the similarities and differences in specific vocal behaviors, overall voice use, and self-perceived vocal use of middle school/high school choral directors in conjunction with classroom sound levels and self-perceived classroom sound levels.

Prevalence of Teacher Voice Disorders

Teachers are considered professional voice users and their vocal use in the classroom has been studied extensively in previous research. Misuse of the voice is the primary variable responsible for tired teacher voices. Teachers are not often trained to effectively and efficiently utilize their speaking voices, the cause of many teacher vocal issues. As vocal issues arise, teachers "may be advised to leave the field of teaching…cautioned to contain their voices… [or] directed to change their personalities and avoid situations or scenes because speaking is involved" (Cooper, 1970). Titze (1997) reported that teachers account for 20% of Otolaryngology (ENT) patients while only making up 4.2% of the U.S. workforce. Of the specific teachers surveyed (N = 242), 20% (n = 48) reported missing between one day and one week of work per year due to vocal conditions. Frequently cited symptoms included: hoarseness, breathiness, weakness, tiredness, effortfullness, and low-pitched voice.

According to Smith, Gray, Dove, Kirchner, and Heras (1997), teachers (n = 242) demonstrated a significantly high frequency of vocal symptoms and physical discomfort from the symptoms compared to their non-teaching peers (n = 178). Over 20% of teachers in the study

reported having to miss work due to vocal health concerns or symptoms. Morton and Watson (1998) found similar results when comparing patient referrals to speech therapy adding that approximately half of teachers interviewed (n = 266) had moderate to severe concerns about their vocal function. Results also suggest that female teachers were three times as likely as males to have speech therapy referrals.

Roy, Merrill, Thibeault, Gray, and Smith (2004) interviewed 2,401 teachers and non-teachers and reported that teachers were more likely than non-teachers to have experienced multiple vocal symptoms including: discomfort, change in voice quality, difficulty projecting voice, trouble speaking or singing, and loss of singing range. Teachers were significantly more likely than non-teachers to attribute their voice problems to their occupation and report lowered job performance due to vocal issues. Additionally, teachers were more likely to consider a career change due to vocal issues.

According to Smith, Kirchner, Taylor, Hoffman, and Lemke (1998), 38% of teachers (n = 205, N = 554) complained of vocal issues and 39% (n = 80) of those participants made changes to their teaching load by cutting back responsibilities as a result. Researchers collected data by mail-in questionnaires. Most frequently reported symptoms included hoarseness (52.3%, n = 145), tired voice (36.1%, n = 100), and speaking lower than normal (31.0%, n = 86). Female teachers reported voice problems significantly more than male teachers. Women also reported a significantly higher average number of symptoms (1.4 vs. 1.0, $p < 0.010$)

Sampaio, Borges dos Reis, Carvalho, Porto, and Araujo (2012) investigated the correlation between teacher self-assessed responses on the 10-question Voice Handicap Index (VHI-10) and the Lifetime Vocal Effort Index (LVEI). The LVEI is determined by multiplying the years of work as a teacher by weekly average number of hours of professional activity.

Though this number does not accurately measure vocal effort, it is a seemingly accurate representation of vocal demand. Researchers surveyed teachers (N = 4496) from across the municipal educational system in Salvador, Bahia, Brazil, representing a response rate of 95.7%. Investigators labeled any respondent who scored 11 or higher out of 40 possible points on the 10-question VHI-10 as having a voice handicap. The prevalence of voice handicap was between 21.3% (n = 695) of those that reported low professional vocal effort (n = 3265) and 28.8% (n = 109) of those that reported high professional vocal effort (n = 379). Several teachers (40.4%, n = 1816) complained of an excessive number of students in the classroom, 19% (n = 854) reported stress from school management, 48.7% (n = 2189) reported excessive noise in the work environment. This particular study found that the number of students in the class was associated with the presence of vocal handicap because teachers need to exert more effort to be heard as well as additional classroom noise from larger numbers of students.

Female Teacher Voice Complaints

To investigate the female teachers' voice, Rantala and Vilkman (1999) measured 12 participants' voice complaints and live acoustic measures of voices during classroom lessons and during breaks. Participants completed questionnaires that designated them as having "few voice complaints" (n = 5) or "many voice complaints" (n = 7). Teachers with many vocal complaints were more likely to have a higher fundamental frequency (F_0) than those with few voice complaints. Teachers with many voice complaints demonstrated lower shimmer (dB) values in-class and during breaks; researchers suggested this may be due to compensation for vocal fatigue and/or added tension.

Similarly, Laukkanen (2008) investigated female teacher vocal fatigue and acoustic vocal measures of primary teachers in Finland. Teachers' (N = 79) acoustic voice parameters were

measured before and after a workday. On average, teachers exhibited higher fundamental frequency (F_0) ($p < .001$), sound pressure level (SPL) ($p < .036$), and alpha ratio values ($p < .001$) at the end of the workday. The increased F_0 correlated positively with tiredness in throat in those with mild phoniatric changes ($r = 0.39$, $p = .026$). Those with no phoniatric changes generally had lower F_0 in both measured readings.

Music Teacher Voice Health

Thibeault, Merrill, Roy, Gray, and Smith (2004) reported higher prevalence of vocal issues in teachers compared to non-teachers and a higher prevalence of vocal issues in vocal music teachers compared to non-music teachers. Researchers conducted phone interviews and completed researcher-devised questionnaire with teachers ($N = 1243$). The majority of teachers (58%, $n = 721$) reported a voice disorder sometime during their career. Researchers reported higher likelihood of vocal music teachers to experience chronic voice disorders (OR=4.1, 95% CI).

Morrow and Connor (2011) compared the daily vocal load of elementary classroom teachers ($n = 5$) and elementary music teachers ($n = 7$) across one standard workweek. Through use of an Ambulatory Phonation Monitor (APM), researchers collected data for total phonation time, fundamental frequency (F_0), and vocal intensity (dB SPL). Elementary music teachers demonstrated significantly higher readings in all measured vocal areas than classroom teachers. Average total phonation time of music teachers proved 48% greater than classroom teachers and the cycle dose of music teachers was 62% higher on average than classroom teachers. The average distance dose for music teachers (7001 m, $SD = 2725$) was nearly twice that of the classroom teachers (3668m, $SD = 1039$).

To determine any relationship between teacher vocal health and teacher burnout, Hendry

(2001) had music teachers (*n* = 17 vocal music, *n* = 8 instrumental music) and non-music teacher (*n* = 12) responded to a researcher-designed questionnaire. Most (56%, *n* = 14) of the music teachers reported past speaking and singing problems. Of the non-music educators, 83% (*n* = 10) reported current vocal issues. 29% (n = 5) of those vocal teachers reported seeking treatment for vocal issues, while none of the instrumental teachers reported seeking treatment. The researcher reported no significant relationships between burnout and vocal health in vocal, instrumental, or non-music teachers.

Miller and Verdolini (1995) researched frequency and risk factors in teachers of singing (*n* = 125 singing teachers, *n* = 49 control participants). Most teachers of singing (64%, *n* = 80) reported previous vocal problems compared to 33% (*n* = 16) of the control group. Most commonly reported symptoms were "loss of high notes," "tired voice," "hoarseness," and "effortfulness." Over half of singing teachers (53%, *n* = 66) sought professional treatment for past vocal issues, whereas, three (6%) of the control participants sought professional help. Of the singing teachers, 17 received a diagnosis of vocal fold pathology; five teachers underwent surgery to remove a laryngeal mass. The researchers reported that no vocal use factors reliably related to current vocal problems, except loud singing, which interestingly was inversely related (OR = 0.34; *p* = .027)

Conversely, Hackworth (2012) utilized speech-language pathologists (*n* = 9) to evaluate recordings of music teachers (*n* = 23) and teachers of other subjects (*n* = 18) in elementary, middle, or high school. Evaluators found no significant differences between music and non-music teacher voices.

Preservice Music Educator Voice Health

To investigate the vocal health of preservice music educators, Manternach (2015)

assessed preservice vocal (n = 6) and instrumental (n = 2) teachers' voice use and corresponding self-rated voice health. Highest vocal doses were reported during student voice lessons, private vocal practice, choral rehearsals, and vocal performance. Vocal doses were lowest during nonperformance music classes and nonmusic classes. Voice emphasis students exhibited higher vocal dose averages during school activities than instrumental colleagues. Participants also logged hours of sleep. Manternach reported a significant low-positive correlation between hours of sleep and vocal quality.

Brunkan (2017) investigated preservice vocal music teachers' (N = 4) voice use and voice changes that occurred during the semester of student teaching based on self-reports of voice use and health, as well as acoustic measures of voice function. All students reported vocal fatigue during student teaching. There were no significant differences in acoustic measures, though pitch and intonation were the only acoustic measures documented.

Similarly, Franca (2013) compared acoustic measures of voice performance of female student teachers (N = 11) at three different points in a semester. Each student teacher's voice was measured in the classroom using an Ambulatory Phonation Monitor (APM), as well as with Computerized Speech Lab (CSL) and Phonatory Aerodynamic System (PAS) software. Student teachers completed the Voice Handicap Index at the first and last data collection points. The researcher reported increased instability and noise in all student teacher's voices across the semester. Statistically significant changes in fundamental frequency, Relative Average Perturbation (RAP), shimmer, Noise-to-Harmonic Ratio (NHR), and Sound Pressure Level (SPL) across the semester all contributed to feelings of increased vocal fatigue in the participants.

In an effort to understand self-perceptions of voice use, Nápoles (2012) investigated self-

estimates, peer estimates, and actual time preservice teachers (N = 32) spoke during choral rehearsals. On the first of two conducting episodes, estimates of teacher talk as a percentage of overall rehearsal time were lower than actual time accumulated. Preservice teachers improved in the second round after they evaluated their initial episode with a stopwatch to find actual time in teacher talk.

Secondary Music Teacher Vocal Health

Schwartz (2009) measured voice range profiles of middle school and high school choral directors (*N = 57; n* = 26 middle school, *n* = 25 high school, *n* = 6 middle and high school). Thirty-five female teachers and 22 male teachers participated. Results of Voice Range Profiles were compared to a previous study with trained and untrained healthy and dysphonic participants. Choral directors had a significantly smaller semitone range when compared with trained singers, yet there was no significant difference between directors and untrained singers. Averaging slightly over two octaves of maximum use, the usable singing range of choir directors was presumed to be smaller than that. Female choir directors demonstrated a smaller semitone range and smaller range of vocal intensity than healthy and dysphonic singers. Female choir directors exceeded both populations in terms of maximum intensity and minimum intensity.

Hopper (2016) examined the verbal behaviors of secondary band teachers (N = 4) during two rehearsals. She determined that band teachers use their speaking voices for a variety of purposes during rehearsals: providing information, giving instructions, providing feedback, error correction, drill, and modeling to teach musical concepts and improve performance. Teaching that incorporated clear, specific language resulted in improved student learning and performance. She also asserted that the amount of spoken instruction could be reduced if paired with a clear, precise conducting gesture.

In order to compare rehearsal behaviors of student, novice, and experienced teachers, Goolsby (1996) monitored teachers during instrumental ensemble rehearsals and found that student teachers talked the most and allowed the least amount of time for playing. Arthur (2002) evaluated time use of experienced choral directors ($N = 5$) during beginning and advanced choir rehearsals. Mean duration of teacher instruction across 10 total rehearsals was 17 seconds for beginning choirs and 16 seconds for advanced choirs. Across several rehearsal segments ($n = 109$) analyzed by Derby (2001), experienced teachers ($N = 12$) talked 33% of the total time with high frequency and brevity, teacher modeling occurred once or twice per minute and accounted for 6% of the total time.

Nápoles (2006) investigated the relationship between teacher talk and student attentiveness by categorizing number of instances and types of teacher talk (including academic information; including reinforcement and academic reinforcement; no academic information, student questions, social tasks; directions only) and measuring time of student silence and eye contact. She observed 30 music rehearsals including middle school ($n = 6$), high school ($n = 6$), and college ($n = 8$). She found correlations between duration of teacher talk and student off-task behavior at all levels. Overall totals of teacher talk were highest at middle school level with the average length of teacher talk at 29.1 seconds. At the high school level, overall teacher talk averaged 13.7 seconds, and at the university level the average was 15.0 seconds.

To gain insight into rehearsal behaviors, Zrust (2017) examined the use of concurrent instruction in secondary choral rehearsals. For this study, he defined concurrent instruction as "any occurrences of teacher phonation (i.e. speaking or singing) while students were in performance of an assigned task (i.e. singing)." Three experienced choral directors participated ($n = 2$ male, $n = 1$ female) by recording 15-minute rehearsals of a choral piece from introduction

to “performance level” (7-17 total rehearsals per conductor). Frequency of participant concurrent instruction varied greatly. Participant 1 averaged 36.96%, Participant 2 averaged 16.04%, and Participant 3 averaged 24.63%. Across participants, 25.88% of rehearsal time was spent in concurrent instruction, with 65% of that being pitched instruction and 35% unpitched instruction.

Brown (2017) compared talk time and classroom sound levels of self-reported dysphonic (n = 3) and non-dysphonic (n = 3) music teachers. All of the non-dysphonic teachers taught at least one choir as part of their course load. Of the dysphonic teachers, one was a choral teacher and taught daily with vocal amplification, the others were band and orchestra teachers. The teachers were recorded during one class period (46-50 minutes) across three consecutive days. Teacher vocal behaviors were coded according to the following categories: talking, talking over students talking, talking over students’ musicing (singing or playing instruments), and talking over other classroom noises (e.g. loudspeaker announcements, instrumental accompaniment, metronomes, tuners). Average amount of talk time for non-dysphonic teachers was 37.90% and 40.15% for dysphonic teachers. Talking over students talking was 21.10% for non-dysphonic teachers and 15.80% for dysphonic teachers. Teacher talk time while students were musicing averaged 4.16% for non-dysphonic teachers and 12.20% for dysphonic participants. Non-dysphonic teachers spent 4.70% of time talking over other classroom noises as opposed to 11.39% for dysphonic teachers. Self-reported dysphonic teachers spoke for an average of 40.15% of total data collection; non-dysphonic teachers spoke for 37.90%. The researcher measured sound decibels in the classroom and labeled anything greater than 80 dBA as “very loud.” Dysphonic teachers spoke over a “very loud” classroom for 27.79% of the collected time and non-dysphonic teachers spoke in a “very loud” environment for 4.78% of the time.

Schiller (2017) compared vocal loading (SPL, F_0, phonation time, vocal loading index

[VLI], and noise SPL) of music teachers (N = 13; n = 9 females, n = 4 males) in French-speaking Belgium. Female teachers exhibited significantly higher vocal loading parameters than their male colleagues. The researcher reported a significant strong positive correlation between background noise level and voice SPL in all subjects and a significant moderate positive correlation between F_0 and background noise level in female subjects. Higher amounts of vocal fold oscillations negatively correlated with vocal quality ratings and positively correlated with vocal fatigue in all participants; more strongly in female teachers.

Classroom Sound Levels

To examine the relationship between vocal integrity and classroom environment, Bernstorf and Burk (1997) evaluated 45 elementary vocal music teachers of a large urban district. Researchers measured self-reported vocal health, classroom sound levels, and length of teacher talk during 80 dBA-90 dBA environments and greater than 90 dBA. Classroom noise was the best predictor of heightened vocal stress and vocal pathology. Teachers noted that working with large groups in "preparation of programs" was vocally stressful.

Bottalico (2016) measured the effect of auditory feedback on the singing voice of professional (n = 10) and nonprofessional (n = 10) singers. He found that the Lombard effect was stronger for nonprofessional singers than professional singers, resulting in a higher Sound Pressure Level (SPL) as the external auditory feedback was lessened. However, professional singers still increased SPL by 2.55 dBA with 20 dBA increase in external accompaniment. He also reported lessened vocal quality, measured through Singing Power Ratio, from both subgroups as the accompaniment levels increased and external feedback reduced.

Pilot Study

I completed a pilot study (2018) to confirm vocal activity categories. To that end, I coded

389 total minutes of one female high school choral director during rehearsals of choirs of varying grade levels. Data were not collected from the same day, but representative of one full day of teaching. I coded teacher voice use according to the following categories: *Speaking Alone, Speaking with Students Speaking, Speaking with Students Singing, Singing Alone, Singing with Students Singing with Piano Accompaniment, Singing with Students Singing with no Piano Accompaniment, Speaking or Singing with Piano, Silence*.

Results indicated the participant used her speaking voice for a total of 171.12 minutes (43.20%) of the time. She used her singing voice for 71.82 minutes (18.03%) of the total time. The remaining 154.45 minutes (38.77%) included no teacher voice use. *Speaking alone* accounted for the majority of teacher voice use (139.18 min., 34.94%). *Singing with Students Singing with Piano Accompaniment* was the next largest portion of teacher voice use (54.25 min., 13.62%). The smallest category of voice use was *Speaking with Student Singing* (1.63 min., 0.41%). After concluding the pilot study, I made alterations to the vocal behavior categories for use in the present study. I eliminated *Speaking or Singing with Piano* for lack of specificity and added *Speaking while Piano Plays* and *Singing while Piano Plays*. *Speaking with Students Singing* divided into two categories: *Speaking while Students Singing with Piano* and *Speaking while Students Singing without Piano. Silence* was renamed to *No Teacher Voice Use* for clarity between teacher vocal silence and classroom silence.

CHAPTER THREE

Method

The purpose of this study was to investigate voice use and vocal behaviors of female middle and high school choral music teachers (N = 3) across three standard school days by measurement of duration of specific vocal activities, average classroom sound levels during specified activities, and self-perceived voice use and classroom sound level for the full day containing middle school choirs, beginning/intermediate high school choirs, and advanced high school choirs. An Institutional Review Board (IRB) approved this study (Appendix A).

Participants

Participants (N = 3) were selected through a purposive sample. In the interest of comparison, all participants were female. Participants completed a demographic questionnaire (see Appendix B). Each participant taught both middle school and high school choir. The teachers all taught in a similar region of a Midwestern state. No teachers reported current vocal pathologies. For anonymity, each participant has been assigned a pseudonym: Mia, Naomi, Gina.

Mia. Mia was 24 years old with 2 years of teaching experience. Aside from serving as a middle school and high school choral teacher, she taught for one semester in an elementary music classroom. She completed her bachelor's degree and 4.5 years of voice lessons while in college. She was not currently taking voice lessons.

Naomi. Naomi was 32 years old with nine years of teaching experience, six at the middle school level, and three at the middle school and high school level. She had completed some coursework toward her master's degree. She reported 12 years of voice lessons, though she was not currently taking lessons. She did report occasional symptoms of acid reflux, though not during the collection process.

Gina. Gina was 31 years old with nine years of teaching experience all at the middle school and high school level. She had completed some coursework toward her master's degree. She reported 11 years of voice lessons and 3 years of summer voice lessons, though she was not currently taking voice lessons.

Classroom Details

Mia. Mia's classroom was a large room with high ceilings and three wide steps, which had chairs on them and were used as risers. Her classroom was situated beside the school cafeteria and the gym, which meant that when the door was open there was additional background noise in the classroom. Two music practice rooms adjacent to the main classroom area also created background noise if used during class time, though this only occurred during sectionals or student-directed projects. The room had a noticeable echo and minimal visible sound dampening measures (e.g. sound absorbing panels). There were two electric keyboards in the classroom. Typically, only one keyboard was used during rehearsals, though occasionally both would be playing during a sectional rehearsal. I measured the room silence with no other persons in the room and no hallway activity. The mean measurement taken during room silence was 41.2 dBA (*SD*=0.9).

Naomi. Naomi taught in two separate classrooms, one at the middle school and one at the high school. She traveled between buildings by foot halfway through the day. Her classroom at the middle school doubled as the band classroom. The ceilings were moderately high, though lower than her ceilings in the high school classroom. There was minimal sound paneling on the walls intended to absorb sound. Her middle school classroom was located in a normal school hallway, which meant minimal background noise during the classes. The HVAC system in this classroom was the loudest of any classroom utilized in this study. The silent room measurement

when the HVAC system was on was 52.3 dBA (*SD*=1.2) and 43.2 (*SD*=0.8) when it was off, representing a large increase in background noise.

Naomi's high school classroom had much more sophisticated sound paneling. The classroom had built-risers and was smaller in size than the middle school classroom. The high school classroom was adjacent to the lunch room, though most of Naomi's time spent during the high school's lunch period was during her plan period and her own lunchtime. There was a practice room off of the main classroom, which was used for some sectional activities and provided some extra noise to the classroom when in use. The mean silent measurement for the high school classroom was 39.7 dBA (*SD*=0.6). Both classrooms had acoustic pianos.

Gina. Like Naomi, Gina taught in two separate classrooms for middle school and high school. She traveled a short distance by car during the school day between the buildings. Her middle school classroom was the smallest in size of all the classrooms utilized in this study. There were standard 3-step choral risers set up for the students to stand on. The room was isolated from other classrooms, so there was little to no background noise from outside the classroom. This classroom had an acoustic piano. The silent room measurement was 39.8 dBA (*SD*=0.3).

Gina's high school classroom was much larger in size and the ceilings were considerably higher. There were no risers in this room and students either stood or sat in chairs. Like the middle school classroom, this room was isolated from other rooms leading to little background noise. This classroom had practice rooms off the main room that were used during some sectional rehearsals and leaked some additional noise into the main classroom when in use. There was one electric keyboard in this classroom. The silent room measurement was 43.2 dBA (*SD*=1.1).

Class Schedules and Student Enrollment

Teacher participants reported numbers of registered students per class period and number and length of class periods during the week.

Mia. Mia taught eight or nine classes per day with one plan period. She taught an advanced mixed high school choir (48 minutes or 98 minutes; depending on day) and two beginning/intermediate high school choirs: a men's ensemble (50 minutes) and a women's ensemble (50 minutes or 98 minutes; depending on day). She taught a middle school choir with seventh and eighth graders (49 minutes), two sections fifth grade (25 minutes each), and two sections of sixth grade (25 minutes each). She also monitored one seminar class (43 minutes). On Monday, she would teach both the advanced high school choir and the women's ensemble. The rest of the week she would teach only one per day for the longer period of time. Student enrollment: women's ensemble, 28; advanced high school choir, 21; 7/8 choir, 58; 6th grade, 56 (divided into two sections); 5th grade, 55 (divided into two sections); and Seminar, 20.

Naomi. Naomi taught between six and seven class periods per day. Two days a week, she taught a before-school advanced high school choir. Since the choir was considered extracurricular, it was excluded from the present study. She taught a 7th/8th grade choir (50 minutes) and a 6th grade mixed choir (55 minutes) before traveling back to the high school. She would then have a "Power Lunch," which would occasionally include coaching solo singers on an appointment basis. She taught two beginning/intermediate high school choirs: tenor/bass Choir (45 minutes) and treble choir (44 minutes). Her curricular high school advanced choir rehearsed for 47 minutes. She ended her day with a study hall period for 22 minutes and worked with individual students after school. The present investigation did not analyze the after-school duties. Student enrollment: 7th/8th grade choir, 54; 6th grade choir, 22; tenor/bass choir, 27;

advanced choir, 35; treble choir, 31; and seminar, 11.

Gina. Gina taught three sections of middle school choir (45 minutes each), which alternated students each day. Each day, she taught an advanced high school choir (50 minutes), and two beginning/intermediate choirs: a mixed ensemble (50 minutes) and a treble choir (50 minutes). Like Naomi, she had travel time, a plan period, and a "Power Lunch," which was used to meet with student soloists by appointment. Student enrollment: 6th grade, 14/15; 7th grade, 14/12; 8th grade, 20/22; advanced high school, 36; mixed ensemble, 41; and treble choir, 30.

Pre-Recording Session Procedures

Each participant completed the validated Singing Voice Handicap-10 questionnaire (Appendix C) at the beginning of the study to assess perceived vocal health.

Mia. Mia responded "sometimes" for the following indicators: singing voice upsets me, no confidence in singing voice, trouble making voice do what I want it to do, singing voice tires easily. She marked "almost never" for the following indicators: unsure of what will come out, voice "gives out while singing," "push it" to produce singing voice, unable to use "high voice." The remaining two indicators received "never" markings.

Naomi. Naomi responded "almost never" for the following indicators: unsure of what will come out, singing voice upsets me, trouble making voice do what I want it to do, singing voice tires easily, something missing in my life because of inability to sing. She marked "never" for the remaining five indicators.

Gina. Gina responded "sometimes" for the following indicators: a lot of effort to sing, voice "gives out" while singing, singing voice upsets me, trouble making my voice do what I want it to do, singing voice tires easily, feel something missing in my life because of inability to sing. She marked "almost never" for the following indicators: unsure of what will come out

when I sing, “push it” to produce singing voice, unable to use “high voice.” The remaining indicator received a “never” marking.

Recording Session Procedures

Audio recording. Each teacher was audio recorded using a professional-grade lavaliere lapel unidirectional microphone manufactured by PowerDeWise (Model number 10765900). The position of the lapel microphone depended on the attire of the teacher; however, I ensured the microphone remained within 5-9 inches of the participant’s mouth. I advised teachers to not wear articles of clothing that could cover or interfere with the microphone function. Since I analyzed recordings based on behavioral voice use as opposed to vocal quality, the microphone placement was not standardized across participants. Microphone settings were set to manufacture suggestions and remained consistent across all participants. The microphone was connected to a single line MP3 recorder manufactured by SONY (IC Recorder, Model ICD-PX720).

Additionally, an Ommani M63 digital voice recorder was positioned between the teacher’s typical front of classroom position and the front row of students. Data from this recorder were used strictly to supplement any lapse of lapel microphone recording and if necessary, to better gauge student activity (speaking, singing, silence).

Classroom sound level measurements. During each class period, I measured live sound levels using a BAFX Sound Level Meter, Model Number DJ778172 after calibration. Sound levels were not specifically measured in a continuous manner by a dosimeter device, which would be indicative of sound levels experienced at ear level of the teacher. Instead, I measured live classroom sound levels from an unobtrusive place in the classroom. These measurements are intended to gain insight into live environmental sound levels. I measured the baseline sound level of the room with no sounds other than naturally occurring room noise and HVAC sounds.

To establish an average sound level during each classroom activity, I collected five measurements during each of the following categories for each class period and reported the averages and ranges of those five measurements. I recorded sound level readings of each of the specified vocal activities: *speaking alone, speaking while students speaking, speaking while students singing with piano, speaking while students singing without piano, speaking while piano plays, singing alone, singing while students singing with piano accompaniment, singing while students singing without piano accompaniment*. I also measured the sound levels of each class performing the following to gain better insight into classroom noise without teacher voice: *students singing at piano dynamic with no piano accompaniment, students singing at piano dynamic with piano accompaniment, students singing at forte dynamic with no piano accompaniment, students singing at forte dynamic with piano accompaniment.*

Participant perception of voice activity and classroom sound level. At the conclusion of the data collection, teacher participants completed an exit questionnaire (Appendix D). Teachers gave an estimate of overall minutes as well as a percentage of total use for each analyzed vocal activity: *speaking alone, speaking while students speaking, speaking while students singing without piano, speaking while students singing with piano, speaking while piano plays, singing alone, singing while students singing with piano accompaniment, singing while students singing without piano accompaniment, no teacher voice use.* I instructed teachers to confirm that the percentages added up to 100% and that total minutes not to exceed the length of the school day. Teachers also estimated average classroom sound level during each of the specified vocal activities. To assist with accurate estimations, I included a guide with decibels corresponding to a recognizable activity or sound (e.g. 40 dBA – quiet library, bird calls; 50 dBA – quiet office, conversation at home).

Post-Recording Session Procedures

Voice activity categories. I coded daily recordings using the following vocal activity categories: *speaking alone, speaking while students speaking, speaking while students singing without piano, speaking while students singing with piano, speaking while piano plays, singing alone, singing with piano, singing while students singing with piano accompaniment, singing while students singing without piano accompaniment, no teacher voice use.* I analyzed recordings during playback utilizing *CowLog 3.0.2* an open-source behavior coding software. I designed hotkeys to use as short cuts for coding and to ensure precision of timing. Backup recording data were used only in instances that needed clarification of student or teacher voice behavior.

Coding definitions. I used the following definitions for coding.

Speaking alone – teacher is speaking by herself, giving direction or conversationally

Speaking while students speaking – teacher is speaking while students are engaging in spoken activities whether instructed or uninstructed.

Speaking while students singing without piano – teacher speaking while students singing without piano. (i.e. concurrent instruction)

Speaking while students singing with piano – teacher speaking while students singing with piano accompaniment (i.e. concurrent instruction)

Speaking while piano plays – teacher speaking while piano plays (e.g. solo direction/feedback, concurrent instruction between student phrases during performance, or behavior management)

Singing alone – teacher sings by herself with no accompaniment

Singing with piano – teacher sings by herself with piano accompaniment

Singing while students singing without piano accompaniment – teacher singing while students

singing without piano accompaniment (e.g. supporting a part that is singing, filling in for a part not currently singing, or modeling accuracy)

Singing while students singing with piano accompaniment – teacher sings while students singing with piano accompaniment (e.g. supporting a part that is singing, filling in for a part not currently singing, or modeling accuracy)

No teacher voice use – teacher voice is silent, does not equate to classroom silence

Analysis. To address research questions one and two, I performed descriptive analyses. To determine reliability of coding measures, a trained individual coded 10% of the total recordings with the coding definitions. Cronbach's alpha analysis determined coding measures to be highly reliable (α=.92).

To address research question three, I performed Pearson correlations to determine accuracy of self-perceived estimates compared to actual figures.

CHAPTER FOUR

Results

Results discussed in regard to each research question. Due to the nature of this case study, I have presented results disaggregated by participant: Mia, Naomi, and Gina. Results are then presented to allow for comparison between participants.

Research Question 1

Mia. I recorded and analyzed a total of 67424.56s (18.73h) of Mia's vocal activities across three complete school days. Day one consisted of 25525.73s; day two, 16931.69s; day three, 24967.15s. Recorder malfunction and relocation of the teacher away from the stable recorder placed in the classroom resulted in shorter collection time on day two. The average length of day-long recording was just over six hours (M=6.24, SD=1.34). Total duration (m) and percentage of overall voice use for each vocal activity across the three days are presented in Table 1.

Table 1

Duration (m) and Percentage of Vocal Activities across Three Days (Mia)

Vocal Activity	Duration (m)	%
Speaking alone	178.15	15.85
Speaking while students speaking	156.95	14.00
Speaking while students sing with piano	20.78	1.85
Speaking while students sing without piano	1.95	0.17
Speaking while piano plays	9.49	0.84
Singing alone	11.88	1.06
Singing alone w/ piano	3.67	0.33
Singing while students sing with piano	86.41	7.69
Singing while students sing without piano	8.86	0.79
No teacher voice use	645.59	57.45

Across the three-day span, Mia utilized her speaking voice in various vocal activities for almost a third of the total recorded time (32.69%) and her singing voice during 9.86% of the total

recorded time. The remaining 57.45% included no teacher voice use. When the same data are considered in a different way, speaking or singing with the piano in any manner accounted for 10.71% of voice use; speaking or singing without the piano measured 17.87% of total voice use while speaking while students speaking accounted for the remainder (13.97%) that was not teacher silence. Overall, Mia sang or spoke with students for nearly a quarter of the recorded time (24.47%) and spoke or sang alone for 18.08%. Out of a total of 18.23 hours of recorded teaching time, Mia used her voice for 7.97 hours.

Daily averages. Data from all three days were used to calculate daily averages of voice use in each specific category. The average daily amounts for Mia are located in Table 2.

Table 2

Average Daily Duration of Vocal Activities across Three Days (Mia)

Vocal Activity	*M* (m)	*SD* (m)
Speaking alone	59.38	32.86
Speaking while students speaking	52.32	17.05
Speaking while students sing with piano	6.93	2.20
Speaking while students sing without piano	0.65	0.40
Speaking while piano plays	3.17	1.92
Singing alone	3.96	1.95
Singing alone with piano	1.22	0.24
Singing while students sing with piano	28.80	18.78
Singing while students sing without piano	2.95	0.85
No teacher voice use	215.20	36.97

Daily totals. In order demonstrate actual voice use during each day, daily durations and percentages are presented in Table 3.

Table 3. *Daily Duration and Percentage of Vocal Activities across Three Days (Mia)*

Vocal Activity	Day 1 (m)	%	Day 2 (m)	%	Day 3 (m)	%
Speaking alone	62.29	14.40	25.61	9.08	91.25	21.93
Speaking while students speaking	66.8	15.70	33.53	11.88	56.60	13.60
Speaking while students sing with piano	5.20	1.22	6.18	2.19	9.41	2.26
Speaking while students sing without piano	0.96	0.22	0.19	0.07	0.80	0.19
Speaking while piano plays	4.15	0.97	0.96	0.34	4.39	1.06
Singing alone	5.00	1.20	1.71	0.61	5.16	1.24
Singing alone with piano	1.14	0.27	1.04	0.37	1.49	0.36
Singing while students sing with piano	19.78	4.64	16.25	5.76	50.40	12.11
Singing while students sing without piano	3.24	0.76	2.00	0.71	3.62	0.87
No teacher voice use	257.88	60.60	194.73	69.01	192.99	46.38

Specific class periods. I organized results for individual class periods into four categories: plan/prep, middle school, beginning/intermediate high school, and advanced high school. Means, durations, and percentages are presented for some or all of the five highest utilized vocal activity categories (*speaking alone, speaking while students speaking, speaking while students singing with piano, singing while students singing with piano, no teacher voice use*). Results also discussed for each class category in terms of the following disaggregations: a) speaking voice, singing voice, teacher silence; b) speaking or singing with the piano, speaking or singing without the piano, teacher silence; and c) speaking or singing alone, speaking or singing with students, teacher silence.

Plan and preparation periods. Mia frequently utilized plan periods, seminars, or lunches to work with students, hold conversations with colleagues or administrators, or complete work silently. On average during this period, Mia spoke alone for 7.10 minutes (*SD*=8.18), spoke while students spoke for nearly an equal amount of time (*M*=7.02m, *SD*=2.5), and spent the majority of the 103.60m (*SD*=11.19m) without using her voice (*M*=88.66m, *SD*=11.18).

Across all days, Mia spoke for 14.18%, sang for 0.23%, and used no voice for 85.58% of these class periods. Alternatively, she spoke or sang with piano for 0.63%, spoke or sang without piano for 6.90% of the total time. Voice use alone comprised 7.03% of total time while voice use while students also vocalized made up an almost equal 7.39%.

Middle school. On average, Mia spoke alone for 29.6 minutes (*SD*=20.01) during her middle school classes. She spoke while students also spoke for 17.02 minutes (*SD*=8.50m), sang while students sang with piano for 10.94m (*SD*=7.30), and utilized no teacher voice for 58.03m (*SD*=35.83). The remaining 9.72 m of the daily average 125.32m (*SD*=65.19) were spent in the other vocal activities.

Of all recorded middle school time, Mia spoke for 40.8% of the time and sang for 12.84%. Teacher silence accounted for the remaining 46.3%. When data were disaggregated differently, Mia spoke or sang with the piano 5.27% of the time and without the piano 27.6% of the time. Finally, Mia vocalized alone for 27.36% of the time and vocalized with students an almost equal 26.33% of the time.

Beginning/intermediate high school. Of the average 92.73m (*SD*=9.17) Mia spent teaching beginning or intermediate high school choirs, she spoke alone for 12.94m (*SD*=7.52), spoke while students spoke for 13.98m (*SD*=11.55), sang while students sang with the piano for 10.24m (*SD*=12.03), and used no teacher voice for 50.26m (*SD*=19.54m).

When total data were disaggregated, Mia spoke during beginning/intermediate choir instruction for 32.75% of the time; she sang for 13.05% of time. The remaining 54% of total recorded time comprised no teacher voice use. Mia spoke or sang while the piano was being played 4.8% of total time, while she spoke or sang without the piano being played 15.8% of the time. Speaking while students speaking accounted for 26.31% of voice use. Finally, Mia spent

29.35% of her instruction time speaking or singing with students, and 16.46% of time while speaking or singing alone.

Advanced high school. Mia instructed an advanced high school choir for an average of 52.94 minutes each day (*SD*=4.37). Of that time, she spent an average of 9.75 minutes (*SD*=1.99) speaking alone, 14.30 minutes (*SD*=5.55) speaking while students were speaking, 7.48 minutes (*SD*=4.24) singing while students sang with piano, and 18.25 minutes (*SD*=3.76) not vocalizing.

Among all voice use during advanced choir instruction, Mia spoke for 49.5% of the time, sang for 16.06% of the time, and used no voice for 34.47%. She spoke or sang with a piano for 4.87% of the time and spent 19.90% of time speaking or singing without piano. She spoke or sang alone for 20.6% of the time and spoke or sang with students 44.5% of her teaching time.

Naomi. I recorded and analyzed a total of 633549.16s (17.60h) of Naomi's vocal activities across three complete school days. Day one consisted of 21282.47s; day two, 20963.44s; day three, 21113.25s. The average length of day-long recording was just under six hours (*M*=5.87, *SD*=0.04). Total duration (m) and percentage of overall voice use for each vocal activity across the three days are presented in Table 4.

Table 4

Duration and Percentage of Voice Use across Three Days (Naomi)

Vocal Activity	Duration (m)	%
Speaking alone	267.45	25.33
Speaking while students speaking	48.22	4.57
Speaking while students sing with piano	7.49	0.71
Speaking while students sing without piano	0.18	0.02
Speaking while piano plays	1.42	0.13
Singing alone	8.92	0.84
Singing alone with piano	7.11	0.67
Singing while students sing with piano	66.77	6.32
Singing while students sing without piano	0.66	0.06
No teacher voice use	647.77	61.34

Across all vocal activities, Naomi used her speaking voice for a total of 34.79% of the total recorded time. She used her singing voice for 10.49% of the time and the remaining 61.14% was spent without teacher voice use. Her time spent speaking or singing with the piano accounted for 11.40% of the total time while speaking or signing without the piano accounted for 27.47% of recorded time. Her vocalizations alone (19.24%) were less than her vocalizations with students (26.04%). Of 17.60 hours of total instruction recorded across the three-day span, Naomi used her voice for 6.80 hours.

Daily averages. Averages for daily voice use in specified vocal categories are presented in Table 5 for Naomi.

Table 5

Average Daily Duration of Vocal Activities across Three Days (Naomi)

Vocal Activity	*M* (m)	*SD* (m)
Speaking alone	89.15	9.80
Speaking while students speaking	16.07	7.04
Speaking while students sing with piano	2.50	1.20
Speaking while students sing without piano	0.06	0.07
Speaking while piano plays	0.47	0.06
Singing alone	2.97	0.27
Singing alone with piano	2.37	0.48
Singing while students sing with piano	22.26	8.97
Singing while students sing without piano	0.22	0.20
No teacher voice use	215.92	13.88

Daily totals. Daily durations and percentages of daily total are presented in Table 6.

Table 6

Daily Duration and Percentage of Vocal Activities across Three Days (Naomi)

Vocal Activity	Day 1 (m)	%	Day 2 (m)	%	Day 3 (m)	%
Speaking alone	88.92	25.07	79.47	22.75	99.06	28.15
Speaking while students speaking	22.75	6.41	16.75	4.79	8.72	2.48
Speaking while students sing with piano	1.63	0.46	1.99	0.57	3.86	1.10
Speaking while students sing without piano	0.13	0.04	0.05	0.01	0.00	0.00
Speaking while piano plays	0.51	0.14	0.50	0.14	0.41	0.12
Singing alone	3.25	0.92	2.95	0.84	2.71	0.77
Singing alone with piano	2.61	0.73	2.68	0.77	1.82	0.52
Singing while students sing with piano	32.29	9.10	15.03	4.30	19.45	5.53
Singing while students sing without piano	0.40	0.11	0.00	0.00	0.26	0.07
No teacher voice use	202.21	57.01	194.73	65.82	215.60	61.27

Specific class periods. See above for description of report for specific class periods.

Plan and preparation periods. On average, Naomi spent 11.85 minutes (*SD*=2.58) speaking alone, 1.14 minutes (*SD*=1.33) speaking with students speaking, and 88.40 minutes (*SD*=31.46) not speaking or singing during her plan and prep periods. Of the average recorded time, plan and prep accounted for 102.03 minutes (*SD*=34.64).

When all recording time was considered, Naomi spent 306.09 minutes in planning and preparation periods. Of that time, she spent 11.61% speaking alone (11.77%, all vocalizations alone), 1.11% speaking while students were speaking (1.59%, all vocalizations with students), and 86.65% not talking. The remaining 0.62% was spent using the other vocal activities. In sum, she spent 12.76% of her time speaking and 0.59% singing. Very little piano was used during vocalization during these periods (0.06%).

Middle school. Naomi spent 88.89 minutes (*SD*=29.90) leading middle school choir rehearsal on average. Of that time, she spent 26.20 minutes (*SD*=13.92) speaking alone, 3.36

minutes (*SD*=1.53) speaking while students were speaking, 8.99 minutes (*SD*=3.88) singing while students were singing with the piano, and 46.40 minutes (*SD*=17.02) without vocalization.

Of the total time recorded in middle school choir rehearsals, she spent 34.31% of time using her speaking voice, 13.49% using her singing voice, and 52.20% not speaking or singing. Speaking or singing with the piano comprised 2.14% while vocalizations without the piano accounted for 45.66% of the total. Vocalizing with students added up to 14.92% of speaking and singing, whereas vocalizing alone came to 32.89%.

Beginning/intermediate high school. Naomi led beginning or intermediate high school rehearsals for 109.16 minutes (*SD*=9.98) on average. She spent about half of that time (*M*=55.17, *SD*=5.18) without using her voice, about a third (*M*=33.07, *SD*=1.20) speaking alone, and 9.87 minutes singing while students were singing with the piano playing.

Naomi used her speaking voice for 38.33% of all the recorded beginning/intermediate rehearsals and used her singing voice for 11.13% of the time. Half (50.54%) of the total time was spent without teacher voice use. Of the total beginning/intermediate high school recorded time, 46.80% was spent without the piano playing; piano during teacher vocalizing was much less of the total (2.67%). Similarly to middle school rehearsals, she spoke or sang alone 32.54% of the time and with students 16.93% of the time.

Advanced high school. Advanced choral rehearsals made up the least amount of Naomi's average day (*M*=51.91, *SD*=1.61). During this time she spent the greatest amount of time (*M*=25.95, *SD*=5.92) not speaking or singing, the next highest amount was spent speaking alone (*M*=18.04, *SD*=1.83), and speaking while students were speaking was the third largest amount (*M*=4.19, *SD*=2.57).

During advanced high school rehearsals, Naomi spoke for the greatest amount of time

(44.10%) compared to the other class categories. She sang for 5.91% of the time and used no voice for the remaining 49.99%. Speaking or singing with the piano comprised 1.31% while speaking or singing without happened for nearly half (48.7%) of the recorded time. Naomi spoke or sang by herself for 35.08% of the time and with students for 14.93%.

Gina. I recorded and analyzed a total of 67861.78s (18.85h) of Gina's vocal activities across three complete school days. Day one consisted of 27641.73s; day two, 26344.41s; and day three, 13875.64s. Microphone malfunction resulted in shorter collection time on day three. The teacher relocated to the Performing Arts Center in her building for the afternoon resulting in a lack of collection from the backup in-class recorder. The average length of day-long recording was just over six hours (M=6.28, SD=2.11). Total duration (m) and percentage of overall voice use for each vocal activity across the three days are presented in Table 7.

Table 7

Duration and Percentage of Voice Use across Three Days (Gina)

Vocal Activity	Duration (m)	%
Speaking alone	264.53	23.39
Speaking while students speaking	127.86	11.30
Speaking while students sing with piano	18.41	1.63
Speaking while students sing without piano	0.34	0.03
Speaking while piano plays	16.03	1.42
Singing alone	11.16	0.99
Singing alone with piano	4.25	0.38
Singing while students sing with piano	148.75	13.15
Singing while students sing without piano	0.33	0.03
No teacher voice use	539.38	47.69

Of the total recorded instruction, Gina spoke for 32.48% of the time and sang for 9.80%. The remaining 57.08% included no teacher voice use. Gina spoke or sang with the piano playing for less time (10.64%) than when the piano was not playing (42.92%). Speaking or singing with students comprised 24.31% of instructional time, while speaking or singing alone made up 17.96%. Out of 18.85 hours, Gina used her voice for 9.86 hours.

Daily averages. Data from all three days were used to calculate daily averages of voice use in each specific category. The average daily amounts for Gina are located in Table 8.

Table 8

Average Daily Duration of Vocal Activities across Three Days (Gina)

Vocal Activity	*M* (m)	*SD* (m)
Speaking alone	88.18	25.74
Speaking while students speaking	42.62	26.67
Speaking while students sing with piano	6.14	2.57
Speaking while students sing without piano	0.11	0.05
Speaking while piano plays	5.34	2.58
Singing alone	3.72	0.46
Singing alone with piano	1.42	0.95
Singing while students sing with piano	49.58	20.14
Singing while students sing without piano	0.11	0.11
No teacher voice use	179.79	90.03

Daily totals. In order demonstrate actual voice use during each day, daily durations and percentages are presented in Table 9.

Table 9

Daily Duration and Percentage of Vocal Activities across Three Days (Gina)

Vocal Activity	Day 1 (m)	%	Day 2 (m)	%	Day 3 (m)	%
Speaking alone	101.67	22.07	104.36	23.77	58.50	25.30
Speaking while students speaking	73.23	15.89	30.26	6.89	24.37	10.54
Speaking while students sing with piano	3.92	0.85	8.95	2.04	5.53	2.39
Speaking while students sing without piano	0.15	0.03	0.13	0.03	0.06	0.03
Speaking while piano plays	3.31	0.72	8.24	1.88	4.48	1.94
Singing alone	3.21	0.70	3.85	0.88	4.10	1.77
Singing alone with piano	1.20	0.26	0.59	0.14	2.46	1.06
Singing while students sing with piano	27.51	5.97	66.96	15.25	54.27	23.47
Singing while students sing without piano	0.00	0.00	0.22	0.05	0.11	0.05
No teacher voice use	246.49	53.50	215.51	49.08	77.38	33.46

Specific class periods. See above for description of report for specific class periods.

Plan and preparation periods. Gina had an average of 90.03 minutes (*SD*=78.28) of

planning and preparation per day. She spent the majority of that time (*M*=75.86, *SD*=66.23) without voice use. She spoke alone for 11.91 minutes (*SD*=16.37). The remaining vocal categories all had two minutes or less during this period of time.

Of all the data collected during planning and preparation periods, Gina spent 84.43% without speaking or singing. The remaining 15.29% and 0.45% were spent speaking alone and singing respectively. She spent most (13.33%) of her time speaking or singing without a piano playing during this time period. Piano accompanying vocalizations accounted for only 0.35%. Gina sang or spoke alone for 13.64% of total time and with students for 2.10%.

Middle school. Middle school rehearsals lasted 123.51 minutes (*SD*=32.77) on average. Gina spent 35.47 minutes (*SD*=14.57) speaking alone, 14.07 minutes (*SD*=6.38) speaking while the students were speaking. A large amount of time (*M*=26.84, *SD*=14.86) was spent singing along with the students while the piano was playing. No voice use occurred for 37.84 minutes (*SD*=20.64) on average.

Gina spoke for 45.51% of the recorded middle school rehearsals and sang for 23.85%. The remaining 30.64% was spent without teacher vocalization. Speaking or singing without the piano accounted for 63.51% of the time and speaking/singing with the piano made up 5.85%. Gina spoke or sang alone and with students for similar amounts of the total time (33.00%, 36.37% respectively.

Beginning/intermediate high school. Beginning/intermediate high school rehearsals made up 109.24 minutes (*SD*=17.38) of Gina's day. She spent 29.50 minutes (*SD*=3.26) speaking alone, 15.47 minutes (*SD*=8.76) minutes speaking while students were speaking, and 15.50 minutes (*SD*=4.48) singing while the students were singing and the piano was playing. She did not use her voice for 44.22 minutes (*SD*=15.41) of the total time during these rehearsals.

During the beginning/intermediate rehearsals, Gina spoke for 44.10% of the total time recorded and sang for 15.42%. No teacher voice use made up the remaining 40.48%. With the piano playing, Gina spoke or sang 3.16% of the time. Conversely, without the piano playing, she sang for 28.05% of the time. Again, she spoke and sang with (29.44%) and without (30.08%) students for approximately equal amounts.

Advanced high school. Gina led advanced choir rehearsals for 54.23 minutes (*SD*=1.85) on average. Of that time, she spent equal amounts of time speaking alone (*M*=11.30, *SD*=3.50) and speaking while the students were speaking (*M*=11.25, *SD*=9.39). She did not use her voice for 21.87 minutes (*SD*=2.03) on average. She spent 7.20 minutes (*SD*=3.07) singing along with the choir while the piano was playing during the average rehearsal.

Gina spoke for a total of 44.71% of the advanced high school rehearsals and sang for 14.97%. Teacher silence (40.32%) was about the same percentage of time as in the beginning/intermediate rehearsal. Speaking or singing without the piano accounted for 55.96% of the total time, while 3.71% of the time was spent speaking or singing while the piano was playing. Gina sang or spoke with the students 36.15% of the total recorded time and sang or spoke alone for 23.53%.

Summary. Grand totals of voice use in the broad categories of speaking and singing for all three teachers are reported in Table 10.

Table 10

Total Speaking and Singing Voice Use (h) for All Three Teachers

Vocal Activity	Mia	Naomi	Gina
Speaking	6.12	5.41	7.12
Singing	1.85	1.39	2.74
Total Vocalizing	**7.97**	**6.80**	**9.86**
Total Teacher Silence	**10.76**	**10.80**	**8.99**

Though order was not consistent, each teacher had the same top four vocal activities: *no teacher voice use, speaking alone, speaking while students speaking, singing while students singing with piano accompaniment*. The remaining vocal behaviors accounted for less than 5% of the average daily activities for each of the teachers. Pie charts representative of average percentage of daily vocal activities are presented for each teacher in Figure 1, Figure 2, and Figure 3.

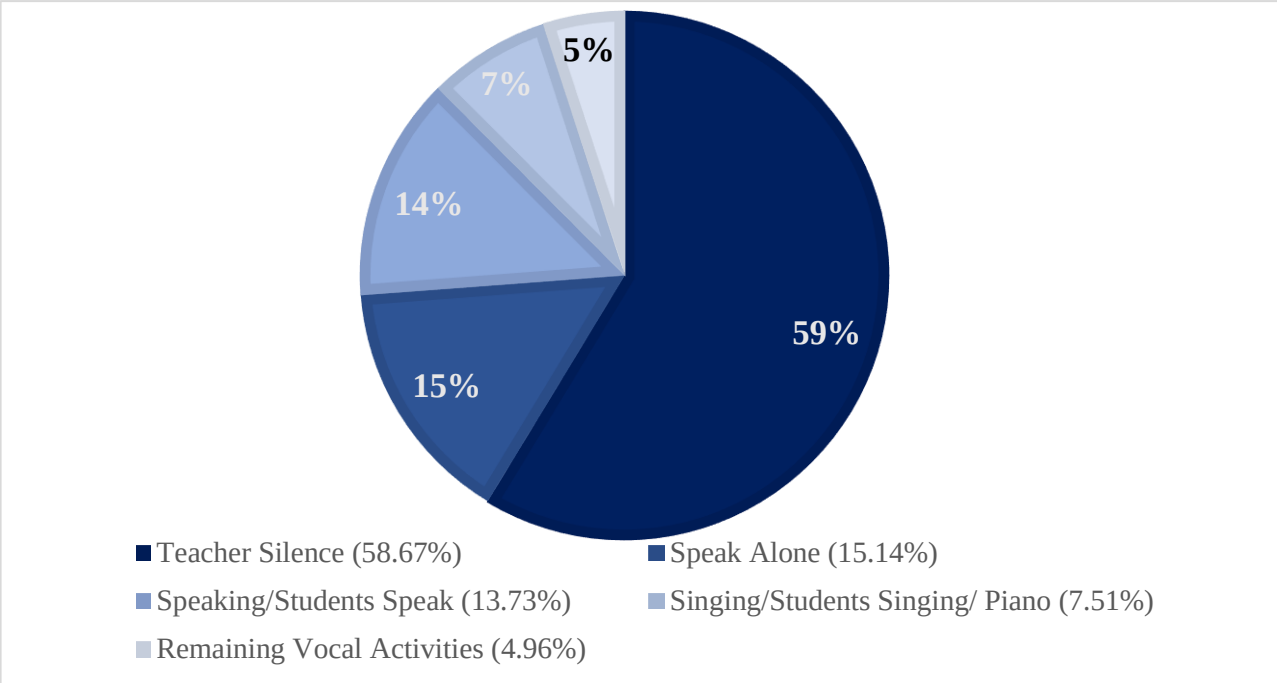

Figure 1. Average percentage of daily voice use presented by vocal activity (Mia).

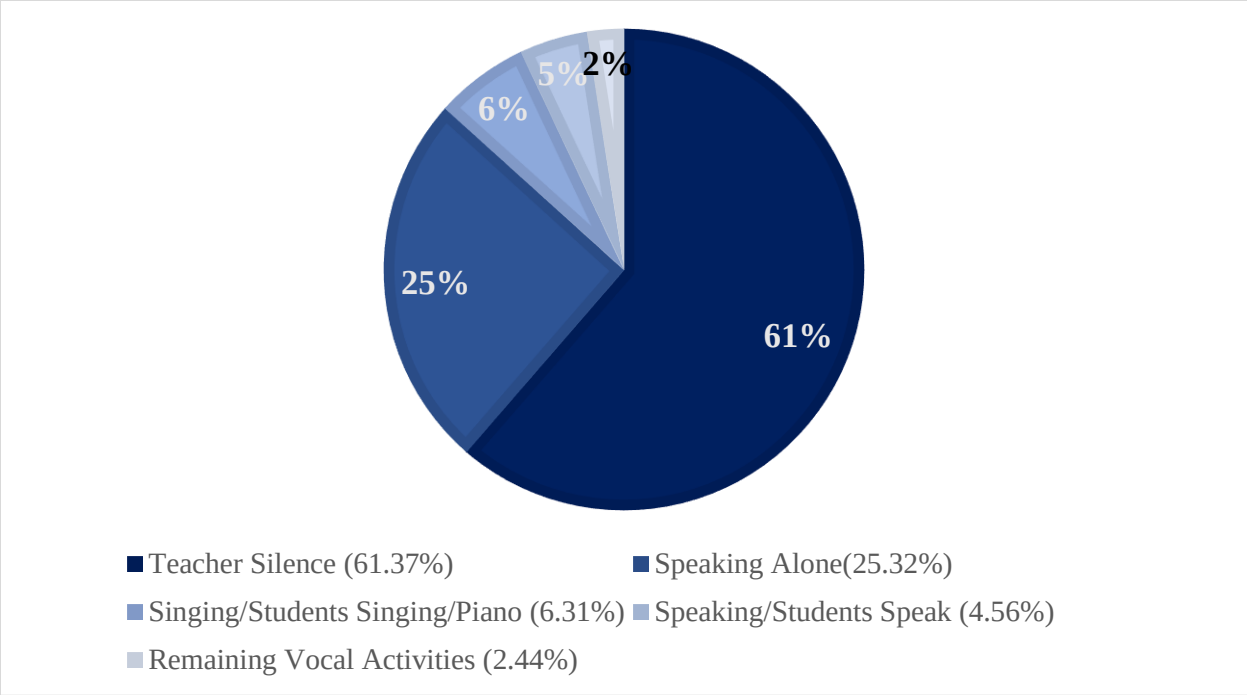

Figure 2. Average percentage of daily voice use presented by vocal activity (Naomi).

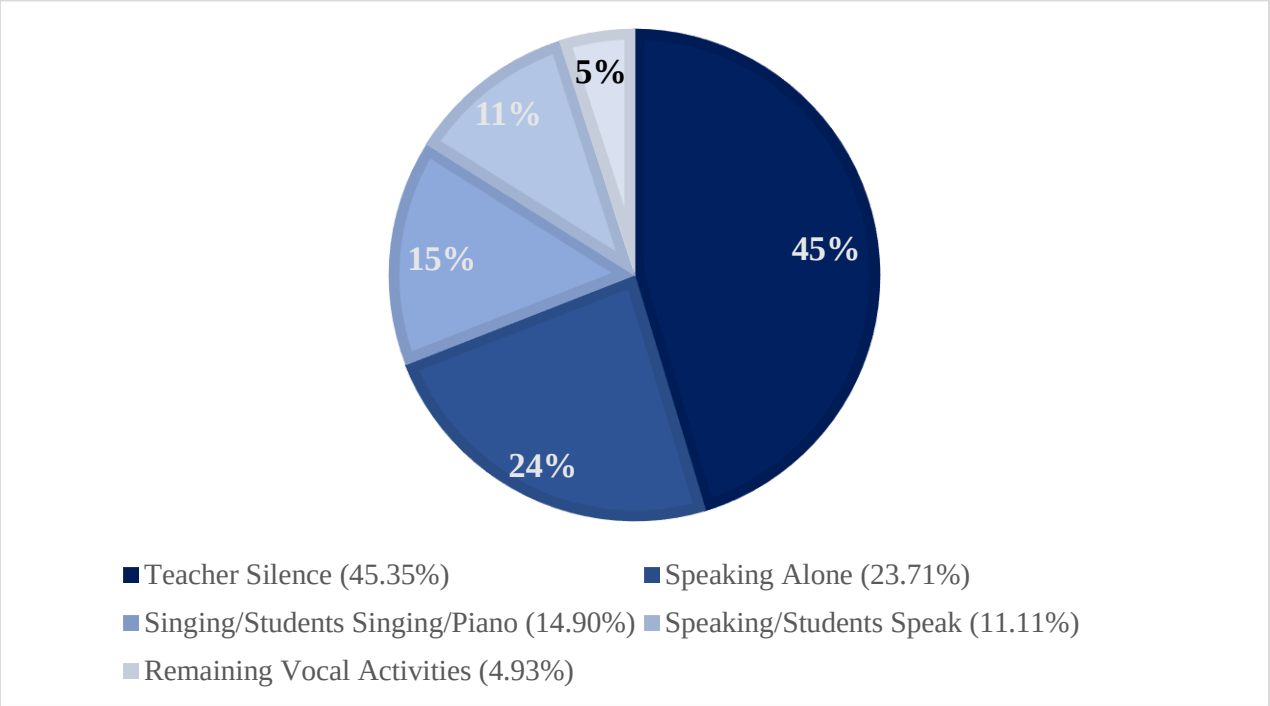

Figure 3. Average percentage of daily voice use presented by vocal activity (Gina).

Disaggregated percentages of five vocal activities (*no teacher voice use, speaking alone, speaking while students speaking, singing while students singing with piano accompaniment, remaining vocal activities*) during each class category (middle school, beginning/intermediate high school, and advanced high school) for all three teachers during entire recorded time are reported in Table 11.

Table 11

Total Vocal Activity Percentages for All Teachers Disaggregated by Class Category

	Mia			Naomi			Gina		
Vocal Activity	MS	BI HS	AD HS	MS	BI HS	AD HS	MS	BI HS	AD HS
No Teacher Voice Use	46.31	54.20	34.47	52.20	50.54	49.99	30.64	40.48	40.32
Speaking Alone	23.62	13.96	18.41	29.47	30.29	34.75	28.70	27.00	20.85
Speaking/Students Speak	13.58	15.07	27.01	3.78	6.76	8.07	11.39	14.16	20.74
Singing/Students Singing/Piano	8.73	11.04	14.13	10.12	9.04	5.64	21.73	14.19	13.29
Remaining Vocal Activities	7.76	5.73	5.98	4.43	3.37	1.55	7.54	4.17	4.80

Note. Percentages here account for all recorded instructional time, not daily averages. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Research Question 2

Mia. Sound levels for Mia's classroom discussed by vocal activity and by classroom activity without teacher voice use.

Sound levels by vocal activity. Mean sound levels (dBA) and ranges for each vocal activity are presented in Table 12.

Table 12

Mean Sound Levels (dBA) And Sound Level Ranges (dBA) For Each Vocal Activity (Mia)

Vocal activity	*M* (*SD*)	Range
Speaking alone	73.9 (4.6)	65.1-85.3
Speaking while students speaking	80.7 (4.5)	69.2-91.9
Speaking while students sing without piano	77.1 (4.3)	68.9-85.2
Speaking while students sing with piano	78.9 (4.6)	71.9-88.1
Speaking while piano plays	76.2 (4.2)	70-85.2
Singing alone	74.4 (5.9)	61.8-91.3
Singing alone with piano	80.3 (5.1)	73.4-89.5
Singing while students sing with piano	83.1 (4.1)	76.7-94.0
Singing while students sing without piano	81.2 (5.1)	69.3-93.9

Class categories. Mean sound levels (dBA) during middle school instruction are reported for each vocal activity disaggregated by class category in Table 13.

Table 13

Mean Sound Levels (dBA) of Voice Activities Disaggregated by Class Category (Mia)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Speaking alone	74.5	4.5	72.0	2.3	75.7	3.0
Speaking while students speaking	82.9	3.4	76.6	0.7	79.7	2.6
Speaking while students sing without piano	77.9	5.5	75.7	1.6	78.5	2.0
Speaking while students sing with piano	79.9	3.6	79.0	5.0	80.8	4.4
Speaking while piano plays	78.0	5.3	75.9	0.1	76.1	3.7
Singing alone	74.2	5.3	72.7	6.9	77.9	2.2
Singing alone with piano	82.9	4.1	77.4	3.6	80.9	3.0
Singing while students sing with piano	82.1	2.9	83.2	4.0	85.9	1.9
Singing while students sing without piano	82.1	4.8	74.3	7.1	79.5	4.1

Note. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Sound levels by non-vocal activity. Sound levels (dBA) and sound level ranges (dBA) for specific classroom activities that involved no teacher voice use are reported in Table 14.

Table 14

Mean Sound Levels (dBA) and Sound Level Ranges (dBA) for Activities without Teacher Voice Use (Mia)

Activity	*M* (*SD*)	Range
Students singing piano dynamic with no piano	71.6 (4.0)	57.6-76.6
Students singing piano dynamic with piano	74.4 (6.2)	65.6-87.1
Students singing forte dynamic with no piano	84.8 (5.2)	70.6-96.5
Students singing forte dynamic with piano	86.7 (4.1)	76.5-94.0
Students musicing in non-singing manner	86.6 (5.5)	72.8-99.1

Class categories. Mean sound levels (dBA) for measured classroom activities without teacher voice use are disaggregated by class category in Table 15.

Table 15

Mean Sound Levels (dBA) for Activities without Teacher Voice Use Disaggregated by Class Category (Mia)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Students singing piano dynamic with no piano	72.8	2.5	69.2	5.0	73.8	1.3
Students singing piano dynamic with piano	74.6	1.4	74.6	7.7	73.1	1.8
Students singing forte dynamic with no piano	85.2	4.0	82.7	8.0	86.9	3.4
Students singing forte dynamic with piano	87.7	3.6	85.5	4.2	91.4	1.2
Students musicing in non-singing manner	86.8	4.6	87.5	1.4	84.5	10.9

Naomi. Sound levels for Naomi's classroom discussed by vocal activity and by classroom activity without teacher voice use.

Sound levels by vocal activity. Mean sound levels (dBA) and ranges for each vocal activity are presented in Table 16.

Table 16

Mean Sound Levels (dBA) and Sound Level Ranges (dBA) for Each Vocal Activity (Naomi)

Vocal activity	*M* (*SD*)	Range
Speaking alone	57.3 (4.3)	45.3-67.4
Speaking while students speaking	68.2 (3.8)	59.3-76.4
Speaking while students sing without piano	70.0 (5.0)	63.0-77.3
Speaking while students sing with piano	77.6 (4.1)	69.4-85.2
Speaking while piano plays	68.4 (5.4)	60.8-81.2
Singing alone	67.3 (2.8)	59.0-75.2
Singing alone with piano	75.5 (2.8)	69.9-81.7
Singing while students sing with piano	84.4 (4.7)	71.1-98.4
Singing while students sing without piano	75.0 (5.8)	60.2-87.2

Class categories. Mean sound levels (dBA) during middle school instruction are reported for each vocal activity disaggregated by class category in Table 17.

Table 17

Mean Sound Levels (dBA) of Voice Activities Disaggregated by Class Category (Naomi)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Speaking alone	59.3	4.2	54.0	3.3	58.9	2.4
Speaking while students speaking	68.7	4.1	66.1	3.8	69.2	2.4
Speaking while students sing without piano	72.4	6.9	70.0	2.6	68.7	6.4
Speaking while students sing with piano	76.8	2.1	76.8	5.6	79.3	3.1
Speaking while piano plays	70.5	6.2	67.3	4.7	65.2	2.7
Singing alone	67.3	2.9	67.2	2.1	67.7	3.3
Singing alone with piano	75.8	2.2	75.4	3.3	75.1	3.2
Singing while students sing with piano	83.5	2.3	81.7	5.0	89.6	4.9
Singing while students sing without piano	74.2	3.9	67.2	9.8	80.4	4.8

Note. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Sound levels by non-vocal activity. Sound levels (dBA) and sound level ranges (dBA) for specific classroom activities that involved no teacher voice use are reported in Table 18.

Table 18

Mean Sound Levels (dBA) and Sound Level Ranges (dBA) for Activities without Teacher Voice Use (Naomi)

Activity	*M* (*SD*)	Range
Students singing piano dynamic with no piano	65.0 (4.2)	56.7-72.3
Students singing piano dynamic with piano	74.4 (3.1)	68.7-80.3
Students singing forte dynamic with no piano	79.3 (4.2)	71.4-85.7
Students singing forte dynamic with piano	80.0 (15.8)	39.5-96.5
Students musicing in non-singing manner	81.4 (16.3)	58.1-106.4

Class categories. Mean sound levels (dBA) for measured classroom activities without teacher voice use are disaggregated by class category in Table 19.

Table 19

Mean Sound Levels (dBA) for Activities without Teacher Voice Use Disaggregated by Class Category (Naomi)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Students singing piano dynamic with no piano	63.4	2.6	65.2	4.9	66.6	4.4
Students singing piano dynamic with piano	75.7	4.0	74.4	3.3	73.6	2.1
Students singing forte dynamic with no piano	74.4	2.4	77.4	2.3	82.6	1.8
Students singing forte dynamic with piano	84.1	2.6	86.4	3.2	90.4	4.1
Students musicing in non-singing manner	72.4	13.8	77.3	7.9	98.2	10.0

Note. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Gina. Sound levels for Gina's classroom discussed by vocal activity and by classroom activity without teacher voice use.

Sound levels by vocal activity. Mean sound levels (dBA) and ranges for each vocal activity are presented in Table 20.

Table 20

Mean Sound Levels (dBA) and Sound Level Ranges (dBA) for Each Vocal Activity (Gina).

Vocal activity	*M* (*SD*)	Range
Speaking alone	56.6 (4.0)	48.2-68.0
Speaking while students speaking	63.8 (5.8)	52.2-80.0
Speaking while students sing without piano	64.8 (5.5)	53.2-74.2
Speaking while students sing with piano	74.9 (3.3)	66.9-82.4
Speaking while piano plays	71.7 (5.8)	56.8-83.1
Singing alone	69.6 (6.6)	57.6-87.5
Singing alone with piano	72.8 (3.8)	63.2-79.8
Singing while students sing with piano	79.3 (3.4)	72.8-88.8
Singing while students sing without piano	73.7 (6.6)	56.3-78.8

Class categories. Mean sound levels (dBA) during middle school instruction are reported for each vocal activity disaggregated by class category in Table 21.

Table 21

Mean Sound Levels (dBA) of Voice Activities Disaggregated by Class Category (Gina)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Speaking alone	57.0	4.4	55.5	3.1	56.9	2.8
Speaking while students speaking	65.7	4.5	63.9	4.1	68.6	3.9
Speaking while students sing without piano	--		68.3	4.2	72.1	1.0
Speaking while students sing with piano	76.3	3.5	74.2	3.0	74.8	3.9
Speaking while piano plays	74.1	4.1	68.5	5.7	72.6	4.3
Singing alone	66.5	5.2	69.5	7.6	67.0	4.2
Singing alone with piano	74.3	3.3	72.3	3.7	73.8	2.4
Singing while students sing with piano	79.7	2.9	79.0	3.9	78.3	2.7
Singing while students sing without piano	--	--	77.0	2.3	--	--

Note. The hash marks mean that there was not enough time spent in that particular vocal activity to gather accurate sound level readings. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Sound levels by non-vocal activity. Sound levels (dBA) and sound level ranges (dBA) for specific classroom activities that involved no teacher voice use are reported in Table 22.

Table 22

Mean Sound Levels (dBA) and Sound Level Ranges (dBA) for Activities without Teacher Voice Use (Gina)

Activity	*M* (*SD*)	Range
Students singing piano dynamic with no piano	63.8 (2.3)	60.2-66.7
Students singing piano dynamic with piano	69.4 (4.2)	58.1-75.7
Students singing forte dynamic with no piano	75.6 (8.1)	63.5-92.5
Students singing forte dynamic with piano	82.2 (2.8)	75.3-90.6
Students musicing in non-singing manner	71.5 (15.6)	39.2-90.3

Class categories. Mean sound levels (dBA) for measured classroom activities without teacher voice use are disaggregated by class category in Table 23.

Table 23

Mean Sound Levels (dBA) for Activities without Teacher Voice Use Disaggregated by Class Category (Gina)

Vocal Activity	MS		BI HS		AD HS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Students singing piano dynamic with no piano	--	--	66.0	0.5	62.0	1.4
Students singing piano dynamic with piano	70.4	4.1	67.6	4.3	70.0	3.7
Students singing forte dynamic with no piano	--	--	76.8	8.3	84.3	2.6
Students singing forte dynamic with piano	80.8	2.3	82.7	3.4	83.0	1.1
Students musicing in non-singing manner	72.4	7.8	78.1	9.2	80.4	7.5

Note. The hash marks mean that there was not enough time spent in that particular vocal activity to gather accurate sound level readings. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Summary. For each teacher, the highest sound levels during a vocal activity occurred while the teacher was singing while the students sang with the piano. Mean results for each classroom are presented in Table 24. Naomi's and Gina's separate classrooms were averaged.

Table 24

Mean Sound Levels (dBA) for Each Classroom during All Vocal Activities

Vocal Activity	Mia		Naomi		Gina	
	M	*SD*	*M*	*SD*	*M*	*SD*
Speaking alone	73.9	4.6	57.3	4.3	56.6	4.0
Speaking while students speaking	80.7	4.5	68.2	3.8	63.8	5.8
Speaking while students sing without piano	77.1	4.3	70.0	5.0	64.8	5.5
Speaking while students sing with piano	78.9	4.6	77.6	4.1	74.9	3.3
Speaking while piano plays	76.2	4.2	68.4	5.4	71.7	5.8
Singing alone	74.4	5.9	67.3	2.8	69.6	6.6
Singing alone with piano	80.3	5.1	75.5	2.8	72.8	3.8
Singing while students sing with piano	83.1	4.1	84.4	4.7	79.3	3.4
Singing while students sing without piano	81.2	5.1	75.0	5.8	73.7	6.6

Note. MS=middle school; BI HS=beginning/intermediate high school choir; AD HS=advanced high school choir.

Mia's classroom was louder than both other teacher's under all conditions except *singing while students sing without piano*.

Under all conditions without teacher voice use, the highest sound levels were recorded while students were singing at a forte dynamic with the piano playing or while students were musicing in some way other than singing. The non-singing musicing was generally clapping rhythms for rehearsal or for a game. Under one specific circumstance, the piece students were singing dictated a scream from the students, which measured above 106dBA. Albeit brief, this was the loudest reading of any classroom.

All classrooms had a wider range of sound levels during the advanced choir rehearsals. The advanced choirs sang softer piano dynamics with the piano than any of the other two levels in all classrooms and also sang louder fortes with the piano than any other class category. The same did not occur consistently when unaccompanied, however.

Research Question 3

As part of the exit questionnaire, participants estimated the total time spent daily in each vocal activity. They also estimated the percentage of time they spent performing each vocal category. Finally, participants estimated classroom sound levels for seven categories (*complete silence, full choir singing with piano at a forte dynamic, full choir singing with piano at piano dynamic, full choir singing without piano at a forte dynamic, full choir singing without a piano at a piano dynamic, teacher speaking alone, teacher signing alone).* Results are presented by individual teacher and in combination.

Mia. Mia's estimates for duration in each vocal activity compared to actual daily means are presented in Table 25.

Table 25

Self-Perceived and Actual Mean Duration and Mean Percentage of Each Vocal Activity (Mia)

Vocal Activity	Self-perceived *M* (m)	Actual *M*(m)	Self-perceived %	Actual %
Speaking alone	25.00	59.38	10.00	15.14
Speaking while students speaking	100.00	52.32	35.00	13.73
Speaking while students sing without piano	20.00	6.93	2.00	1.89
Speaking while students sing with piano	20.00	0.65	5.00	0.16
Speaking while piano plays	30.00	3.16	5.00	0.79
Singing alone	30.00	3.96	2.00	1.01
Singing alone with piano	15.00	1.22	3.00	0.33
Singing while students sing with piano	100.00	28.80	25.00	7.51
Singing while students sing without piano	20.00	2.95	8.00	0.78
No teacher voice use	60.00	215.20	5.00	58.67

Mia's estimated average classroom sound levels (dBA) and actual measured sound level means are presented in Table 26.

Table 26

Self-Perceived and Actual Mean Sound Levels (dBA) (Mia)

Activity	Self-perceived dBA	Actual dBA
Complete silence	20.0	41.2
Forte with piano	100.0	86.7
Piano with piano	80.0	74.4
Forte without piano	90.0	84.8
Piano without piano	60.0	71.6
Teacher speaking alone	70.0	73.9
Teacher singing alone	80.0	74.4

Naomi. Naomi's estimates of average duration and percentages for each vocal activity are presented with the actual means and percentages in Table 27.

Table 27

Self-Perceived and Actual Mean Duration and Mean Percentage of Each Vocal Activity (Naomi)

Vocal Activity	Self-perceived *M* (m)	Actual *M*(m)	Self-perceived %	Actual %
Speaking alone	50.00	89.15	20.00	25.32
Speaking while students speaking	30.00	16.07	10.00	4.56
Speaking while students sing without piano	5.00	2.50	1.00	0.71
Speaking while students sing with piano	5.00	0.06	1.00	0.02
Speaking while piano plays	5.00	0.47	1.00	0.13
Singing alone	30.00	2.97	1.00	0.84
Singing alone with piano	10.00	2.37	1.00	0.67
Singing while students sing with piano	120.00	22.26	40.00	6.31
Singing while students sing without piano	35.00	0.22	10.00	0.06
No teacher voice use	143.00	215.92	15.00	61.36

Naomi's estimated average classroom sound levels (dBA) and actual measured sound level means are presented in Table 28.

Table 28

Self-Perceived and Actual Mean Sound Levels (dBA) (Naomi)

Activity	Self-perceived dBA	Actual dBA
Complete silence	20.0	45.4
Forte with piano	110.0	86.7
Piano with piano	60.0	74.4
Forte without piano	60.0	83.8
Piano without piano	50.0	65.0
Teacher speaking alone	110.0	57.3
Teacher singing alone	70.0	67.3

Gina. Gina's estimated and actual duration means and mean percentages are presented in Table 29.

Table 29

Self-Perceived and Actual Mean Duration and Mean Percentage of Each Vocal Activity (Gina)

Vocal Activity	Self-perceived *M* (m)	Actual *M*(m)	Self-perceived %	Actual %
Speaking alone	30.00	88.18	10.00	23.71
Speaking while students speaking	50.00	42.62	5.00	11.11
Speaking while students sing without piano	15.00	6.14	10.00	1.76
Speaking while students sing with piano	35.00	0.11	10.00	0.03
Speaking while piano plays	30.00	5.34	5.00	1.51
Singing alone	60.00	3.72	10.00	1.12
Singing alone with piano	15.00	1.42	10.00	0.49
Singing while students sing with piano	120.00	49.58	25.00	14.90
Singing while students sing without piano	15.00	0.11	2.00	0.03
No teacher voice use	120.00	179.79	13.00	45.35

Gina's estimated average classroom sound levels (dBA) and actual measured sound level means are presented in Table 30.

Table 30

Self-Perceived and Actual Mean Sound Levels (dBA) (Gina)

Activity	Self-perceived dBA	Actual dBA
Complete silence	20.0	41.5
Forte with piano	90.0	82.2
Piano with piano	75.0	69.4
Forte without piano	80.0	75.6
Piano without piano	65.0	63.8
Teacher speaking alone	60.0	56.6
Teacher singing alone	75.0	69.6

Summary

In order to present accuracy of teacher's estimations, I have compiled correlation coefficients for each teacher for each measure (duration, percentage, and sound level) and presented them together in Table 31.

Table 31

Correlation Coefficients (r) for Mean Duration (M), Percentages, and Sound Levels (dBA)

Measure	Mia	Naomi	Gina
M Duration (m)	0.367	0.764	0.682
Average %	0.073	0.327	0.358
Sound Levels (dBA)	0.976	0.458	0.975

Mia and Gina were most successful at accurately estimating the sound levels for each vocal activity presenting a strong, positive correlation. All participants had the weakest correlations with their estimates of average percentage of voice activities.

Summary of Findings

Research question one. Among all three teachers, the highest percentages were devoted to *no teacher voice use, speaking alone, speaking while students speaking,* and *singing while students singing with piano accompaniment*. Gina had the highest amount of overall voice use.

Mia spoke while students were speaking nearly as frequently as speaking alone, while Naomi spoke much less while students were speaking than speaking alone. On average, Mia and Gina spoke or sang with their students for an equal or greater amount of time as time spent vocalizing alone. Naomi sang or spoke with her students much less time than the time spent speaking or singing alone. Overall, each teacher used her speaking voice more than her singing voice. Planning and preparation periods had the least amount of voice use. Speaking while students were speaking was higher for all teachers in the advanced high school setting than middle school or beginning/intermediate high school. Singing while student were singing with the piano was the greatest at the middle school level for Naomi and Gina, and the advanced high school level for Mia.

Research question two. For all teachers, the classroom sound level was the lowest while speaking alone. Classroom sound levels were highest while the teacher was singing along with students with the piano playing. For all three teachers, the classroom sound level was the softest while speaking alone to the beginning/intermediate high school choirs. Classroom sound levels were the loudest while speaking alone to the middle school choirs for Naomi and Gina, and the advanced high school choirs for Mia. Of the measurements while the teachers were speaking while students were speaking, sound levels were highest in the advanced high school choir setting for Naomi and Gina and the middle school setting for Mia. Students singing at *forte* dynamic with the piano playing was the loudest singing category without teacher voice use for Mia and Gina. Naomi's highest average classroom sound level without teacher voice use was students musicing in a non-singing manner. Singing while students were singing with the piano was the loudest in the advanced high school choral setting for Mia and Naomi, and the loudest in the middle school setting for Gina. Advanced high school choirs generally had higher and lower

sound levels when singing *forte* and *piano* with the piano respectively.

Research question three. All teachers were least successful at estimating percentages of specific vocal behaviors. All teachers overestimated amounts of total voice use and all teachers underestimated time spent speaking alone. All other vocal behaviors were overestimated. Mia and Gina were more successful at estimating classroom sound levels accurately than voice behaviors.

CHAPTER FIVE

Discussion

This investigation builds on studies exploring duration of music teachers' voice use throughout the school day (Brown, 2017; Zrust, 2017; Nápoles, 2006; Goolsby, 1996; Hopper, 2016; Teters, 2018). Among primary findings: (a) female secondary choral teachers spend the majority of voice use in the classroom speaking alone, speaking while students are speaking, and singing while students sing with piano accompaniment; (b) female secondary choral teachers speak more while students are speaking in advanced high school choir than in middle school or beginning/intermediate high school choirs; (c) female secondary choral teachers sing while students are singing and piano was playing more often in middle school choir than high school choirs; (d) the highest classroom sound level occurs when teachers are singing along with students singing with piano accompaniment; (e) the use of the piano in the secondary choral classroom is largely responsible for high sound levels; (f) female secondary choral teachers underestimate amount of time spent speaking alone; and (g) female secondary choral teachers overestimate total voice use during instructional time.

These findings are confined to the three teachers included in this study and during the three days of collection. Nonetheless, they warrant reflection and can serve to deepen professional discussion regarding choral teacher voice use, classroom environmental sound levels, and self-perceptions of voice use. To that end, the following discussion will address the three research questions that guided this investigation. I will discuss findings in the context of previous research, offer suggestions for future research, address weaknesses and limitations of the present study, and propose implications for choral music education.

Research Question One

The first research question focuses on female secondary choral teacher voice use and the duration of specific vocal activities throughout the day and at varying levels of instruction. I will compare results of the present study within the context of previous research that have attempted to quantify the length of time music teachers are speaking or phonating throughout the day.

In this investigation, each teacher's total voice use results exceed the total phonation time mean (M=107.86; SD=21.91) reported by Morrow and Connor (2011). Naomi was the only teacher who fell within the high end of the standard deviation, while Mia had nearly twice the phonation time on average. Since Morrow and Connor only investigated elementary music teachers, this variance may be a result of teaching differences between elementary music and secondary music.

For the purpose of comparison with Goolsby's (1996) results, I will label all speaking alone or with students speaking as "verbal instruction." Since content of vocalizations was not assessed during the present investigation, there is a high likelihood that instruction may have occurred outside of those categories (e.g. a teacher may have sung an instruction), nor is it entirely instructional based, this should merely serve as an attempt to contextualize results within the greater body of research. That being said, Mia's total percentage of verbal instruction was well-below that of Goolsby's experienced teachers; Naomi's was in line with novice teachers; and Gina's was closer to student teacher category. When experience of the teachers is taken into consideration, Mia would fall in Goolsby's novice category and both Gina and Naomi would be categorized as experienced teachers. The differences in the present study may be explained by the fact that the full three-day analysis is considered in the present study instead of two rehearsals, or it could be due to the differences in the nature of choir and band rehearsals.

Total concurrent instruction (speaking or singing while students are singing) percentage totals were well below the 25.35% reported by Zrust (2017). This discrepancy can be easily explained by the fact that Zrust analyzed 15-minutes of rehearsal, while the present investigation analyzed the entirety of three days of instruction. When participant planning period voice use totals are removed from the overall average percentages, Mia and Gina actually participated in concurrent instruction for greater percentages of time than Zrust's percentages (31.00% and 33.69%, respectively). Naomi's results still remained well below (15.80%). It is important to note; however, that the present percentages include *speaking while students are speaking*, which may or may not be considered concurrent instruction. That parameter is outside of the present analyses, though, analysis of this type may be an avenue for future research.

All teachers in the present investigation demonstrated voice use times that exceeded the averages for both dysphonic and non-dysphonic teachers in Brown's (2017) investigation of three 45-60 minute teaching episodes. This difference could be due to the shortened teaching episodes measured by Brown, particular content being covered that day, and status of music being rehearsed (e.g. early stages vs. late stages of preparation). Future research may consider analyzing dysphonic and non-dysphonic teachers for longer periods of time or across several months to determine if any other environmental factors correlate with dysphonia in music teachers.

Compared to the pilot study I completed (2018), teachers spoke and sang less on average than the teacher in the pilot study and used *no teacher voice* for a longer period of time. Mia and Naomi spent less average time *singing while students singing with piano accompaniment* than the teacher in the pilot study; Gina participated in this activity for slightly longer. That being said, the pilot study did not include plan periods and seminars and strictly investigated class time

and passing periods. When only class time is considered, the results of this investigation are more consistent with the pilot study. During rehearsal periods, Mia and Naomi spoke and sang less than the pilot study teacher (39.76%, 38.10%, and 43.20%, speaking, respectively; 13.54%, 10.89%, and 18.03% singing, respectively). Gina spoke and sang slightly more (44.82%, 18.96%).

Inconsistencies in data collection across these studies and truncated recording sessions may be responsible for the widely differing results and thus more research is necessary to determine how teachers are employing their voices in the classroom. Future research may investigate the reliability of analysis of short teaching episodes and the transferability or consistency with the rest of the day or week of that particular teacher. Furthermore, researchers must consider the differences between active rehearsing and plan periods or independent student work throughout the day when considering daily vocal loading. The results of the present study demonstrate wide variance from previous investigations, which presents a direct need for continued investigation into the vocal behaviors of secondary choral and broadly, teachers of music. Specifically, future research may consider the type and content of vocalizations throughout the day to determine if activities could be eliminated in an effort to preserve the vocal instrument and avoid vocal health complications.

Within the context of this study, the three teachers are relatively consistent across participants in the matters of length of time for speaking and singing. Two major deviations between the teachers include length of time spent *speaking while students speaking* and *singing while students singing with piano accompaniment*. While overall vocalization duration is relatively consistent, these two areas were of great variance.

To address the first category, I present an anecdote from the data analysis that was

outside the realm of analysis, but is worthy of mentioning here. There were many instances in the recordings where teachers would discipline students for speaking while they were speaking, or raising voice over student sound to gain attention. For example one teacher stated, “Please make sure your voice is not louder than my voice, so you can hear instructions.” The teacher proceeded to speak over students speaking for several more minutes. Though this was outside of the realm of the present study, it does bring to light the impact that classroom management may have on teacher voice use. Future research should investigate the connection between classroom management systems and teacher voice use. Similarly, future research may investigate the possible connections between teaching and management style (both actual and self-perceived) and teacher voice use. Future research may also consider teacher voice use during management compared to use for musical activities.

In contrast, teachers sometimes utilized the category *speaking while students speaking* to propel musical learning. For example, each of the teachers was in the process of teaching choreography to students in at least one of their classes and would have students chant the song text while performing the dance moves. In this instance, the vocal behavior may be reduced to preserve vocal load. Instead, choral teachers may consider supporting students vocally as minimally as possible, which additionally could serve as a point of assessment. Future research may consider the possible benefits of speaking with students speaking compared to benefits of listening while students are speaking on student success, as well as on vocal loading.

Singing while students are singing with piano accompaniment was one of the top voice use categories for all three teachers. On the exit questionnaire, one teacher wrote “Bad Habit!” next to her estimate of time for this particular category. While she ultimately overestimated how much she participated in the behavior on the particular days of data collection, she brings to

question the purpose of participating in that vocal behavior. Another teacher wrote on the demographic questionnaire that she knew she sang too much with her students and that she was very aware of her habits. Anecdotally, while watching and listening to teachers teach this behavior appeared to occur in one of two situations: (a) the teacher was either trying to guide students to sing the correct notes, or (b) she was simply singing along seemingly automatically.

With the addition of the piano, the classroom sound level was much higher and often, the piano was playing the parts of the students while the teacher would sing the part along with them. According to previous research, the high classroom sound level and Lombard effect would make this vocal activity one that contributes quickly to overall vocal loading. It may be worth considering if the teacher's voice is actually contributing to student learning and/or confidence, or if it is impairing the teacher's ability to properly analyze problems. Future research may further investigate the vocal loading impact of the *singing while students are singing with piano* accompaniment and also the connection between singing with the students with or without the piano.

Research Question Two

The second research question focuses on environmental sound levels at the time of particular vocal activities and student activities. While an imprecise measurement of what the teacher may be directly experiencing, the data do provide some insight into the classroom environment and draw attention to sound sources that contribute greatly to the sound level: the teacher and the piano.

Wide sound level ranges and large standard deviations for each vocal activity present a logical issue with making broad judgments about this particular data set for each teacher. I have identified trends that will require thorough research to determine validity and/or transferability.

Nonetheless, sound level data provide a bigger picture of what is happening within the classroom and future researchers of teacher voice use should include live sound level measurements in their data collections.

Classrooms where the teacher was *speaking alone* consistently presented the lowest sound levels for each teacher. Mia is a naturally loud speaker and her values for *speaking alone* were at least 10dBA higher (+10.0dBA results in a doubling of psychoacoustic loudness) than the other two teachers. That being said, since this was not measured at mouth level, it is very likely that the room acoustics increased the sound level. Anecdotally, Mia mentioned that the room's echo made it very loud and would often bother her because of the sound levels reached when students were speaking. Teachers *speaking while students are speaking* was, on average, 6-11dBA greater than teachers *speaking alone* depending on the teacher. This increase in sound level likely creates the Lombard effect, which may be a contributing factor to higher vocal load for the teacher.

Measuring vocal loading, vocal effects of the Lombard effect, and hearing doses were outside of the realm of the present study. Future research should investigate how each of these factors impact music teacher voice use throughout a school day.

Brown (2017) reports that dysphonic teachers spend more time talking in classrooms louder than 80dBA than their non-dysphonic peers. In the present study, both Naomi and Gina had classrooms with sound level means that stayed under 80dBA (with the exception of Naomi's *singing with students singing with piano accompaniment*), though the maximum of some of the ranges exceeded 80dBA; especially those with the piano playing. On the other hand, four of Mia's classroom sound level averages exceed 80dBA with maximum of the ranges extending into the 90dBA range for some categories. The high classroom sound levels may relate to

heightened vocal stress and/or vocal pathology (Bernstorf & Burk, 1997).

Though teachers did not partake in *speaking while students sing with piano accompaniment* for long durations, it was the second highest environmental sound level for both Naomi and Gina. For Mia, this activity recorded as the fifth highest sound level. Choral teachers may consider three things about this particular vocal activity: a) the high sound level likely means Lombard effect is occurring, b) the high sound level may put the teacher at risk for vocal stress or vocal pathology, and c) the high sound level and fact that students are engaged in the activity of singing may reduce the intelligibility and impact of a teaching statement. Oftentimes, these vocal comments are short blurbs shouted out over the sound of the choir. While outside of the context of the present investigation, future researchers may investigate the impact of this instruction and value in the learning process. If the students and the final musical products are not benefitting from these vocalizations, then the teacher may be able to remove them in an effort to reduce vocal loading.

Choral music teachers may consider the role that the addition of the piano plays during rehearsal. One of the teachers remarked that her schedule was difficult at the middle school and students struggled to retain music; therefore she relied on the piano as the "quickest way to learn" repertoire. Future research should consider the validity of that assumption and evaluate if the piano really needs to be a permanent fixture in the learning process for students in the choral classroom or if other options, such as teacher modeling or solfège systems, yield better or "quicker" results. Since teachers are already spending a large amount of time *singing while students are singing with piano accompaniment* and this is the loudest classroom environment for all teachers, future research may consider if this is more useful to students than those options without piano accompaniment. Based on data in the present study, sound levels would be

reduced if the piano were used with less frequency. This reduction in piano sound may also result in reduced vocal stress.

Research Question Three

The third research question focused on self-perception of voice use by activity and classroom sound levels. My intention was to gain an understanding of how much teachers believe they are using their voices and in what manner. The data collected by this type of investigation could be important in structuring future music teacher education, provide insight to teachers themselves, and provide a foundation for suggesting strategies to guide teachers to make adjustments to current vocal use.

Generally, the teachers in this investigation were unsuccessful at estimating the amount of voice use time for each activity. Teachers consistently underestimated the time spent speaking by themselves, while simultaneously overestimating the amount of time spent speaking while students were speaking. The estimations for teacher silence were also consistently underestimated by an hour to two hours. The underestimation of teacher silence is perplexing; however, my assumption is that teachers did not take plan periods and lunchtime into consideration when figuring teacher silence. Those periods of time were generally spent without much teacher voice use for the teachers and contributed a large amount to the *no teacher voice use* means.

Two of the teachers were excellent at estimating the sound levels of their classrooms, demonstrated by the Pearson correlation. My primary hypothesis for the reason of this success was the image with sound level anchor points given with the exit questionnaire. With a point of reference, two of the teachers were able to closely estimate the average levels. That being said, it did not seem to help the third teacher who was much less successful at estimating the average

sound levels. Each teacher used the “silent room” anchor (20 dBA) and directly applied it to her own classroom perception resulting in each teacher underestimating classroom “silence” by about 20 dBA each. This was perhaps misleading and potentially skewed results for that one response.

Future research may include auditory examples to assist teachers in estimation or provide a chart with anchored examples specific to a choral music classroom. Researchers may also consider removing the anchor chart altogether to discover if teachers have any self-perception of loudness without that reference. Admittedly, this method would assume the teachers have a working understanding of sound level measurements.

Since having a reference was helpful to two of the teachers, a similar reference may be devised to assist teachers with estimating their own amounts of teacher talk. If teachers were able to evaluate “average” vocal activity durations and percentages while making their estimates, they may have an easier time situating themselves within that data set. However, that method would make it less obvious that teachers have a difficult time accurately self-assessing their voice use.

The results of the present study are representative of three choral music educators across three standard days of instruction. Though it would be incorrect to assume these results are widely transferrable, there are a few points that current music educators, preservice music educators, and faculty instructing preservice students can gain from this investigation. To begin, there is widespread agreement that music teachers, and specifically choral teachers, are experiencing high levels of vocal loading and in some cases, vocal distress as a result of job requirements. The present study demonstrates a small, though thorough, examination of the experiences of three teachers as a starting point for the discussion of what current teaching practices may warrant change. Teachers should weigh the benefits and consider the necessity of

vocalizing during rehearsals under particular conditions, especially those that occur within loud environments like singing with students with piano accompaniment, or speaking while students are singing with the piano. Preservice teachers, as well as current teachers, should develop an awareness of time spent speaking and singing during rehearsals and look for moments that could be adjusted to preserve the voice. Instructors of preservice music educators should monitor student voice use and encourage nonverbal communication when appropriate and effective.

When I came to collect data one of the days, the teacher told her students that I was there to "see how mean [she] was to [her] voice." While said in jest, this statement encouraged the idea that choral teachers misuse and abuse their voices as part of a day's work. The present study's results are merely a reflection of what is occurring currently presented with a hope that by knowing what is actually happening in the classroom, alternative and more vocally-friendly teaching practices may be developed.

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Appendix A
Approval of Protocol

March 7, 2018

Caitlin Teters caitlin.teters@ku.edu

Dear Caitlin Teters:

On 3/7/2018, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Vocal Activities and Live Classroom Sound Levels of Middle/High School Choral Teachers: A Collective Case Study
Investigator:	Caitlin Teters
IRB ID:	STUDY00142089
Funding:	None
Grant ID:	None
Documents Reviewed:	• Demographic Questionnaire, • Exit Questionnaire, • Singing Voice Questionnaire, • Teacher Voice Use Consent Form.docx, • Teacher Voice Use Protocol.pdf

The IRB approved the study on 3/7/2018.

1. **Notify HRPP about any new investigators not named in original application. Note that new investigators must take the online tutorial at https://rgs.drupal.ku.edu/human_subjects_compliance_training.**
2. **Any injury to a subject because of the research procedure must be reported immediately.**
3. **When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.**

Continuing review is not required for this project, however you are required to report any significant changes to the protocol prior to altering the project.

Please note university data security and handling requirements for your project:
https://documents.ku.edu/policies/IT/DataClassificationandHandlingProceduresGuide.htm

You must use the final, watermarked version of the consent form, available under the "Documents" tab in eCompliance.

Sincerely,

Jocelyn Isley, MS, CIP
IRB Administrator, KU Lawrence Campus

Appendix B

Demographic Questionnaire

1. **Age: _____**
2. **Years of high school / middle school choir teaching experience: _____**
3. **Years of other teaching experience (preschool, elementary or college): _____**
4. **Highest level of education completed (circle one):**

Bachelor's Some Master's Master's Some Doctorate Doctorate

5. **Currently taking voice lessons: Yes No**
6. **Please describe any previous vocal training (number of years, level, etc):**
7. **Any current vocal pathology concerns?**

8. **Fill in your typical weekly class schedule including: (a) contracted classes taught, (b) before or after school duties, (c) start/end times, (d) grade level.**
   If class is repeated, just list class name.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY

9. For each of your classes, list the total number of students enrolled:

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Class: _____No. enrolled: _____

Appendix C
Singing Voice Handicap-10

These are statements that many people have used to describe their singing and the effects of their singing on their lives. Mark the response that indicates how frequently you have the same experience in the last 4 weeks.

	Never	Almost Never	Sometimes	Almost Always	Always
It takes a lot of effort to sing.					
I am unsure of what will come out when I sing.					
My voice "gives out" on me while I am singing.					
My singing voice upsets me.					
I have no confidence in my singing voice.					
I have trouble making my voice do what I want it to.					
I have to "push it" to produce my voice when singing.					
My singing voice tires easily.					
I feel something missing in my life because of my inability to sing.					
I am unable to use my "high voice"					

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Appendix D

Exit Questionnaire

1. **Please estimate the total time (in minutes) that you spend in the following vocal activities throughout a normal school day.**

    a. **Speaking Alone: _____ mins**
    b. **Speaking while Students Speaking: _____mins**
    c. **Speaking while Students Singing (without piano): _____ mins**
    d. **Speaking while Students Singing (with piano): _____mins**
    e. **Speaking while Piano Plays: _____mins**
    f. **Singing Alone: _____mins**
    g. **Singing Alone while Piano Plays: _____mins**
    h. **Singing while Students Singing (without piano): _____mins**
    i. **Singing while Students Singing (with piano): _____mins**
    j. **Teacher Silence: _____mins**

2. **Please estimate the percentage of your total voice use spent in the following categories. (Please ensure total of percentages is 100)**

    a. **Speaking Alone: _____%**
    b. **Speaking while Students Speaking: _____%**
    c. **Speaking while Students Singing (without piano): _____ %**
    d. **Speaking while Students Singing (with piano): _____%**
    e. **Speaking while Piano Plays: _____%**

f. **Singing Alone: _____%**

g. **Singing Alone while Piano Plays: _____%**

h. **Singing while Students Singing (without piano): _____%**

i. **Singing while Students Singing (with piano): _____%**

j. **Teacher Silence: _____%**

TOTAL : 100%

3. **Please estimate the sound level of the classroom during the following situations. Use the attached ranges to assist you.**

   a. **Complete Silence: _____dBA**

   b. **Full choir singing with piano at *forte* dynamic: _____dBA**

   c. **Full choir singing with piano at *piano* dynamic: _____dBA**

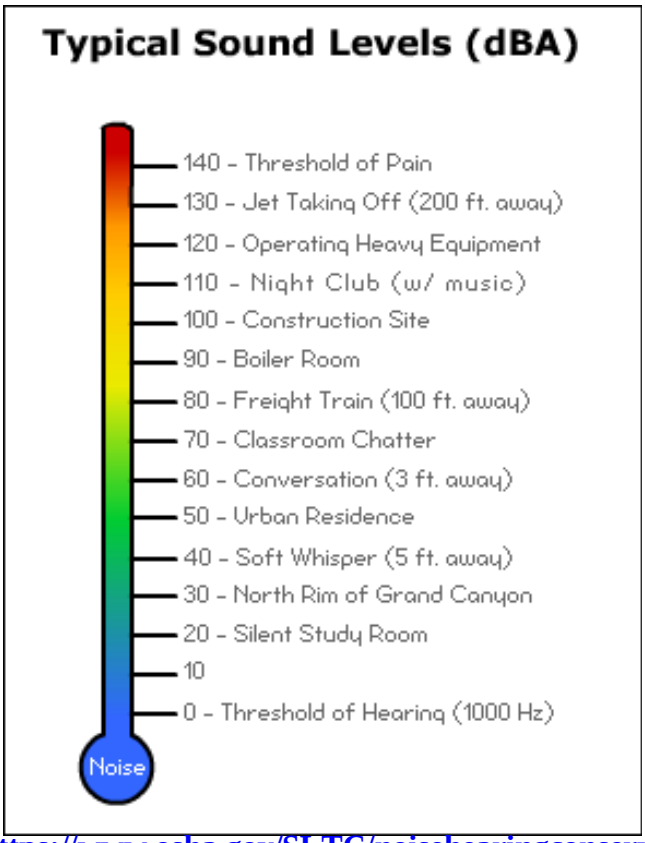
   d. **Full choir singing without piano at *forte* dynamic: _____dBA**

   e. **Full choir singing without piano at *piano* dynamic: _____dBA**

   f. **Teacher speaking alone: _____dBA**

   g. **Teacher singing alone: _____dBA**

4. **Any additional comments that you have about your voice quality or voice use, specifically as it pertains to you in-class and out-of-class behaviors.**



https://www.osha.gov/SLTC/noisehearingconservation/